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HARRIS'S SPARROW AND THE STUDY OF IT BY TRAPPING

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With Colored Frontispiece by George Miksch Sutton

The Harris's Sparrow (*Zonotrichia querula*) is a favorite with many bird students within its limited range. "A bird of imposing appearance (for a sparrow)", wrote Coues (1903), thereby expressing the situation quite well. Its large size, distinctive markings, vigorous call notes, remarkable song, abundance in certain districts especially during migrations, and the scientific interest in it that has been inspired by its limited distribution and the mystery that so long surrounded the location of its summer home, have combined to attract attention to the species.

The earlier discoveries of this species, by Thomas Nuttall, Prince Maximilian, and J. J. Audubon have been admirably and fully set forth by Harry Harris (1919c), and therefore require no amplified discussion here. Suffice to say that on April 28, 1834, while the party under Captain Nathaniel J. Wyeth, bound for the Columbia

*In the fall of 1921 the senior author decided to attempt "A Brief Biography of the Harris's Sparrow," in which the more important facts known concerning the history, distribution, nesting, migrations, wintering, habitat, general habits, food, voice, plumages and measurements of this interesting sparrow would concisely be presented. Much progress was made on this paper in 1922, including a practically complete review of the literature concerning the species to that year, but in 1923 pressure of other matters forced work on this incomplete paper to be suspended. In the fall of 1927, the large number of Harris's Sparrows taken by the junior author in his traps impressed upon him the unusual opportunity offered by this species for study by the trapping method. Correspondence was begun by him with the hope that some one in the winter range of the bird would take the lead, but without success, so that it seemed desirable to him also to prepare a summary of our knowledge of the species, together with the banding results to date, in order to outline more definitely the lines of study and to interest other students in the problem. This correspondence, however, had the result of making known to the co-authors their two planned papers, and in June, 1928, the present joint paper was projected by agreement between them. The junior author should, however, be given complete credit for the pages devoted to the discussion of trapping and banding. The preliminary manuscript has been examined by members of the Bureau of Biological Survey of the U. S. Department of Agriculture. The generous co-operation of many other people is indicated through the text, and portions of the manuscript have been submitted to several of these for correction or further suggestions.—THE AUTHORS.

River country, of which Thomas Nuttall and J. K. Townsend were members, was a few miles west of Independence, Missouri, and approaching Westport, the probable type specimen of Nuttall's "Mourning Finch (*Fringilla querula*)" was taken, within or close to the present city limits of Kansas City, Missouri. A few days later, on May 5, 1834, Nuttall (1840) again heard this bird's "long, drawling, monotonous and solemn note *te de de de*" near the Red Vermilion River, a tributary of the Kansas River in Pottawatomie County, Kansas.

At almost the same time that Nuttall discovered the species in Missouri and Kansas, Prince Maximilian of Wied, in descending the Missouri River, reached "Belle-Vue" (now Bellevue, the oldest town in Nebraska, located in Sarpy County a few miles north of the mouth of the Platte River) at noon on May 13, 1834, and there his hunters collected this sparrow, which Maximilian (1841) named *Fringilla comata*.

Nine years later, while J. J. Audubon and his party were ascending the Missouri River, when a little above Fort Leavenworth, on May 4, 1843, Edward Harris shot a "new finch" which later in the same year Audubon (1843) named "Harris's Finch (*Fringilla harrisii*)", in honor of his "excellent and constant friend," its discoverer, apparently all ignorant of the prior describing and naming of the bird by both Nuttall and Maximilian. On May 6, 7 and 8, 1843, farther up the river, Harris shot additional specimens of this bird, and on the return trip shot an immature specimen at Fort Croghan (below the present Omaha and a little above Bellevue, Nebraska) on October 5, 1843, which Audubon figured with the adult male in his plate.

Beginning with Gambel (1847) authors in technical nomenclature mainly properly referred to the species as *Zonotrichia querula* (Nuttall), but the vernacular name applied by Audubon has been the one that has persisted to the present time.

General Distribution

The distribution of the Harris's Sparrow in the United States, except as more or less of a rarity, is oddly restricted to a narrow area west of the Mississippi River, lying between the meridians of 94° and 100° north of the 28th parallel. In winter it occupies an area of only about 200 by 900 miles extending from southeastern Nebraska to central Texas. During migrations it is abundant between these same longitudes in the northern States. Eastward it is common through northwestern Missouri and most of Iowa, occurring rather

frequently in southern Wisconsin and northern Illinois, rarely in Michigan, Indiana, Ohio, and Ontario, and accidentally in Massachusetts. Westward the range in which it is common is somewhat more restricted, and it is uncommon in the western parts of Kansas, Nebraska and South Dakota. In Colorado, Wyoming, and Montana it seems to be more or less rare. Through North Dakota and Canada its path tends a little more to the west, and from North Dakota northward it spreads decidedly westward, covering most of Saskatchewan and a considerable part of Alberta. In the southward migration a few of the birds turn westward and reach British Columbia or points farther south, but these are probably to be regarded as straggling individuals separated from the main flocks and traveling with other species.

Summer Range

For many years the summer habitat of the Harris's Sparrow was much of a mystery. Lingering as it did in the Missouri Valley until late in May or even early in June, it was thought for a long time that it must nest at no great distance north of the United States, if it did not actually do so within its boundaries. Maximilian (1841) and Aughey (1878) both thought it nested along the Missouri River in eastern Nebraska. Later writers suggested that it nested in Minnesota, Dakota, Montana, or Manitoba. In fact, Bendire (1889) described the nest and eggs of a bird, supposed probably to be this species, found June 24, 1885, on the Little Horn River near Fort Custer, Montana. But as further explorations in these regions failed to disclose nesting birds, the possibilities moved farther north.

It was not until 1900 that the true summer home of the Harris's Sparrow was finally discovered. In that year Preble (1902) found it rather common near Fort Churchill on the western shore of Hudson Bay (about lat. 57°), July 23 to 30, where he collected not only adult birds of both sexes but young birds just from the nest. None of the nests themselves were found by Preble, but he considered that the birds nested among the scattered patches of dwarfed spruce growing in the small valleys and ravines along the Churchill River, where they were found commonly.

Again in 1903 Preble (1908) noted several Harris's Sparrows near McTavish Bay, the southeastern arm of Great Bear Lake, on August 23, and four days later encountered them in small flocks among the dwarfed spruces along the southern shore of the Lake just west of McTavish Bay. Both adult and young of the species were

present "in a habitat precisely similar to its chosen nesting ground on Hudson Bay. All indications therefore point to the conclusion that its principal breeding grounds are in the strip of stunted timber extending for 800 miles between Hudson Bay and Great Bear Lake, along the northern border of the transcontinental forest."

Seton (1908) in 1907 noted the Harris's Sparrow, first on Kahinouay Island in the eastern part of Great Slave Lake on July 20, where it was evidently nesting, and later from there northwardly up to the edge of the Barren Grounds, finding it abundant and evidently nesting in every large thicket. On August 5, at the limit of tree growth on Artillery Lake, a nest was found on the ground under a dwarf birch. This nest was made of grass, resembled that of the White-throated Sparrow, and contained three young nearly able to fly.

Fleming (1919) has given records of birds taken by Buchanan at the end of July, 1914. These include both adults and young taken on the Cochrane River. Mr. H. H. Mitchell (letter October 30, 1928) writes that there is some doubt as to the locality, but that it probably was twenty-five or thirty miles east of the Saskatchewan-Manitoba boundary at about latitude 58°30′.

When Preble (1908) was working down the Slave River and northwestward as far as Fort Rae in May, 1900, he saw migrating Harris's Sparrows only at Fort Chipewyan. Following the same direction in 1903 he did not find these birds until he was nearly to Great Bear Lake.

Thus through the discoveries of these ornithologists the mystery of the breeding grounds of the Harris's Sparrow largely has been solved. Evidently it is in the strip of dwarfed timber margining the northern edge of the forests of the Hudsonian Life Zone, from the eastern shore of Great Bear Lake to the western shore of Hudson Bay, and up to the very edge of the Arctic Barren Grounds. Here the bird spends the period from June to September, nesting and rearing its single brood of young in a seclusion from man that is almost absolute. Nesting must take place in the latter part of June, July, and early August. Further search may extend the known breeding range a little more by disclosing nesting birds at other points in western Canada.

Distribution During Migrations

In the following pages are given the detailed accounts of the known distribution of the Harris's Sparrow in the various parts of its range outside of the breeding area. These will serve as a frame-

work upon which to build a more nearly complete record. More data are needed upon the comparative abundance of the species in the western part of its migration range, especially in northern Minnesota, Manitoba, Saskatchewan, and Alberta.

Central Canada

Our knowledge of the distribution of the Harris's Sparrow in the northern part of its migration range is limited by the paucity of observations from that region. Cooke (1913) reported it from the Arctic Red River (probably at about long. 133°, lat. 68°) in June. Preble (1908) found it in September, after the nesting season, near McVicar Bay (120°, 65°), thirty miles west of there, near Manito Islands a little farther west, and at Fort Franklin (124°, 65°), and recorded its occurrence, as observed by H. W. Jones, at Willow River, near Fort Providence (118°, 61°30′) late in May, and at Hay River (about 117°, 60°), where a "large flock" was seen from May 26 to June 15. Cooke (1913) also reported it from the latter locality in May.

The province of Manitoba must be well covered by the migration. Preble (1902) found them on the upper Hayes River late in August, and commonly near the Echimamish River, just northeast of Lake Winnipeg. Cooke (1888) recorded its occurrence at the Shell River (long. 101°, lat. 51-52°) and (1913) reported on six years of migration at Pilot Mound (99°, 49°15′) and on sixteen years of migration at Aweme, about fifty miles northwest of Pilot Mound (see also Criddle, 1922). Seton (1886) reported it as an abundant migrant at Red River (97°, 49-50°), Big Plain and Souris (100°, 49°30′). McDougal (1924) trapped thirteen at East Kildonan in 1923. Mr. A. G. Lawrence supplies numerous additional records from southern Manitoba, especially from Winnipeg (97°, 50°). From Saskatchewan, Cooke (1913) reported on three years of migration at Indian Head (104°, 50°30′) and its occurrence at Osler (107°, 52°30′) in mid-May. Mr. L. B. Potter writes (letter December 17, 1928) that at Eastend in southwestern Saskatchewan (109°, 49°30′) these sparrows occur quite regularly but usually in limited numbers. Cooke (1913) reported its ocurrence at Brooks, Alberta (112°, 50°30′) and on four years of migration at Flagstaff (111°30′, 52°30′). Preble (1908) recorded them at Lily Lake (north of Edmonton, at about 113°30′, 53°30′), at Athabasca Landing (113°30′, 54°30′), and at Fort Chipewyan (111°, 59°). Mr. H. M. Laing writes (letter July 30, 1928) that the farthest west that he has taken them is at Belvedere, Alberta (114°20′, 54°). Apparently from central North Dakota the western

edge of the main migration path bends sharply westward, passing through the general region of Regina and Saskatoon, and thence on across northeastern Alberta.

Minnesota

The Minnesota localities reported on for migration dates of the Harris's Sparrow by Roberts (1879) and Cooke (1888 and 1913)—Lanesboro, Fillmore County; Heron Lake, Jackson County; Minneapolis, Hennepin County; Elk River, Sherburne County; Lake Andrew, Kandiyohi County; and Frazee City and White Earth, Becker County—are all in the southern and western parts of the state, south of latitude 46° and west of longitude 95°. The same is true for Pipestone, Pipestone County, where it is recorded by Mr. P. Lewis (Hatch, 1892) and Mr. Alfred Peterson. These birds seem to occur quite regularly in migrations in eastern Minnesota from Minneapolis southward, but are much less common there than in the western part of the state (see trapping records, p. 166). There is only one early winter record, from Fairmont, Martin County (lat. 43°30′) reported by Hagerty (1914). The localities in the northern part of the state cited by Cooke (1888), as well as those received from Dr. T. S. Roberts (letter April 19, 1929), are all west of longitude 95°, except one from St. Louis County (92°). It seems possible that the main body of migrating birds may be deflected westward by the forests. Dr. Roberts writes that the absence of records from the northern part of the State may be due only to lack of observers in that section and that he has recently received a record of the occurrence of Harris's Sparrows at Deer River in Itasca County.

North Dakota

Harris's Sparrows are abundant in migrations through the eastern part of North Dakota as far west as Jamestown (long. 99°), and, probably less so, from there to Bismarck (long. 101°). Most of the published records are from along the Red River and east of longitude 98°—Grafton, Walsh County (Wood, 1923, and Williams, 1926); Grand Forks, Grand Forks County (Cooke, 1913); Fargo and Argusville, Cass County (Cooke, 1888); and Anselm, Ransom County (Wood, 1923). No records are available from the southwestern part of the State. Mr. Russel Reid writes (letter March 16, 1928) from Bismarck: "I see only scattered individuals in the spring, but sometimes large flocks in the fall." Coues (1874) collected a series from the Mouse (or Souris) River (long. 101-102°, lat. 49°) in 1873, and Cooke (1913) reported it from Antler, Battineau County, in the same region. Larson (1928) considered it "tolerably common" in eastern

MeKenize County (long. 103°30′). Mr. J. H. McClelland, loeated at Arnegard, MeKenzie County (farther from the river) writes (letter Mareh 28, 1928) that he sees a few birds at a time, never common.

South Dakota

In South Dakota the Harris's Sparrow is an abundant migrant in the eastern part of the State. Agersborg (1885) lists it as one of the most abundant migrants in southeastern South Dakota. Most of the published reeords are from about longitude 99° or eastward—Fort Sisseton (MeChesney, 1880), Turtle River and Vermilion (Cooke, 1888), Fort Randall (Coues, 1874), Sanborn County (Visher, 1913), Sioux Falls (Larson, 1925), Lennox (Mallory, 1924), ete. The migration range, however, extends west to about longitude 102°. Dr. F. V. Hayden (Baird, 1858) collected one at Medicine Creek, Lyman County, Oetober 8, 1856. Visher (1909) noted that these brids were reported by E. H. Sweet as eommon in 1907 and 1908 in Stanley (now Jaekson) County, between Interior and Kadoka and northward (long. 102°). Tullsen (1911) reeorded that he saw three birds at Lake Creek (now Laereek), Bennett County (also long. 102°), and Visher (1912), on the authority of Tullsen, later reported the speeies as "eommon in migrations" on the old Pine Ridge Indian Reservation (now Washabaugh, Bennett, Shannon, and Washington Counties). Mr. W. H. Over writes (letter Mareh 26, 1928) that he has no reeords for the Black Hills (less than 100 miles west of the last eited loeality). There is one early winter reeord, from Dell Rapids, Minnehaha County (lat. 43°45′), reported by Anderson (1924).

Nebraska

Over that portion of Nebraska lying east of longitude 99° the Harris's Sparrow is, in general, a regular and eommon migrant. Actual reeords of its oeeurrenee are at hand from Riehardson, Nemaha, Otoe, Cass, Sarpy, Douglas, Gage, Laneaster, Saunders, Dodge, Cuming, Dakota, Antelope, Holt, Nanee, Seward, Saline, Jefferson, Nuekolls, Webster, Adams, Hall, Kearney, and Buffalo Counties. These eounties all lie in about the eastern one-third of the State. There are but very few reeords of the oeeurrenee of this bird west of longitude 99° in Nebraska. Rev. J. M. Bates has noted it on a few different oeeasions at Kennedy and elsewhere in Cherry County. Mrs. Lulu K. Hudson reports it as an uneommon migrant at Simeon, northeast of Kennedy, and Mr. F. M. Dille reports having seen but a very few at Valentine, Cherry County, during several years of residenee there. The senior author saw some along the Niobrara River south of Valentine in the

fall of 1910, and found them common at Halsey, Thomas County, the same fall, as reported by Zimmer (1913), who saw the species in the same locality in the spring of 1912. Childs (1908) saw Harris's Sparrows at the forks of the Dismal River in Hooker County. Mr. Wilson Tout identified the species once from North Platte, Lincoln County. Mr. Miles Maryott found the species to be a rare migrant in the vicinity of Oshkosh, Garden County. Zimmer (1911) secured a Harris's Sparrow from a flock of Western Tree Sparrows in the valley of the White River near Crawford, Dawes County. Dawson (1921) saw a single bird in Monroe Canyon, Sioux County, in the extreme northwestern part of the State.

Eastern Nebraska is at the northern limit of the wintering range of the Harris's Sparrow. Cary (1900) reported that a small flock remained at Neligh, Antelope County, along the Elkhorn, throughout the severe winter of 1898-99. At Omaha, Douglas County, along the Missouri, and at Plattsmouth, Cass County and Fremont, Dodge County, along the Platte, in spite of the presence of apparently good winter cover, these birds leave for farther south late in December and do not winter through at those places. They do winter through, however, at least in some winters, at Dunbar (a little west of Nebraska City in Otoe County); Lincoln, Lancaster County; Beatrice, Gage County; Fairbury, Jefferson County; Superior, Nuckolls County; Red Cloud, Webster County; and Hastings, Adams County—or in southeastern Nebraska south of latitude 41° and east of longitude 99°. They are especially common during the winter at Fairbury, along the Little Blue River, where the Misses Callaway have conducted their banding operations for the past five years.

Iowa

This State is north of the regular winter range of the Harris's Sparrow. Mills (1928) reports one seen at Pierson, Woodbury County (lat. 42°30′), December 27, 1927. The birds migrate commonly over the western and middle portion of the State but are comparatively uncommon in its eastern one-third. Tripp (1873) listed it as abundant and described its season and song as observed in Decatur County (long. 94°, lat. 40°30′); Baird, Brewer, and Ridgway (1875) recorded it being twice taken in Jasper County (93°, 41°30′); and Cooke (1884) recorded it from Mitchell, Mitchell County (92°45′, 43°30′) and later (1888) from Iowa City, Johnson County (91°30′, 41°30′) and Des Moines, Polk County (93°30′, 41°30′). Jones (1895) gave it as a regular migrant at Grinnell, Poweshick County (92°45′). Wilson (1906) has recorded it as rare in Scott County (90°30′, 41°30′).

Anderson (1907) cited records of the species from Scott and Johnson and from three additional counties between the Mississippi River and about longitude 92°—Winneshiek, Lee (see also Widmann, 1907) and Van Buren—the reporters of which all agreed that it is rare in that part of Iowa. However, Mr. H. R. Dill (letter March 27, 1928) rates it as "fairly common" in Johnson County in early winter, and Miss Althea R. Sherman (1909) at National, Clayton County (91°15′, 43°), six miles from the Mississippi River, considers it neither rare nor irregular at that point, where she has kept exceptionally complete records for the last twenty years. She writes (letter June 28, 1928) that "some seasons it is seen here forty days or thereabout (in the fall), in others only a few—1907 (5 days), 1912 (11), 1913 (6), 1914 (1), 1917 (5), 1918 (7), 1926 (6). The largest number for any one day is twelve on October 16, 1921. The years 1911, 1916, 1921, and 1924 are the only years when six or more birds were counted on one day." Records cited by Cooke (1913) indicate that the species is a regular migrant in Poweshiek, Warren (93°30′) and Woodbury (96°) Counties. Spurrell (1918) and Mrs. Battell (1924) have reported its occurrence at Ames, Story County (93°30′). Anderson (1907) says that in Winnebago and Hancock Counties (long. 94°) this sparrow is a common migrant, often abundant in the fall. Mr. W. M. Rosen finds it a common migrant at Ogden, Boone County (94°) and Spurrell (1921) reported it as a regular and abundant migrant, both spring and fall, in Sac County (95°). Beck (1924) reported it from Denison, Crawford County (95°30′). From latitude 95° to the western border of Iowa it is an abundant migrant.

Missouri

The Harris's Sparrow is common during migrations through western Missouri, and the eastern limits of the area in which it may be called common are apparently about as in Iowa (from longitude 93° westward). Nuttall (1840) discovered the species near the present Kansas City, as has been described. Hoy (1864) in May, 1854, found it at Chillicothe, Livingston County (93°30′) and Lexington, LaFayette County (94°). Scott (1879) described his observations of the species at Warrensburg, Johnson County, where it was quite common. Wilson (1896) found it common at St. Joseph, Buchanan County, in the fall of 1894. Widmann (1907) records it from southwestern Missouri at Jasper, Jasper County (Savage) and at Freistatt and Pierce City, Lawrence County (Nehrling). He states that it is a rare straggler in eastern Missouri, citing the records from Keokuk, Iowa (Currier); Warsaw, Illinois (Worthen); Quincy, Illinois (Pol-

ing); and Lincoln County, Missouri, as well as the record from Mt. Carmel, Audrain County, April 3, 1884 (Mrs. M. Musick), previously given by Cooke (1884 and 1888). To these he adds (letter March 28, 1928): Jefferson City, Cole County; Arcadia, Iron County; and Bonfils, Clayton and St. Louis, St. Louis County. These localities range from longitude 90°20′ to 92°10′ and are all north of latitude 37°30′. The Christmas censuses published in *Bird-Lore* show that occasional birds winter in the counties along the western edge of the State—Tarkio, Atchison County (Salmon); Maryville, Nodaway County (Cameron); Concordia, Lafayette County (Schreimann); and Marionville, Lawrence County (Neff). Mrs. W. W. Holliway at Rockport, Atchison County, in the extreme northwestern part of the State, writes (letter November 19, 1928) that usually the birds are seen there from the middle of October until the middle of December, but that in the winter of 1927-28, which was very open, some were seen January 10 and one was trapped February 18. From Marionville, in Lawrence County (93°45′, 37°), Mr. J. A. Neff (letter April 1, 1928) writes: "Some seasons they winter in large numbers, sometimes sparsely, and occasionally none stay all winter." From his (1923) paper on the birds of the Ozark Region this seems also to be the status of the bird through that region generally.

Kansas

In Kansas the Harris's Sparrow is abundant during migrations west to about longitude 98°, and especially between longitudes 96° and 98°. The finding of it near the Red Vermillion River, Pottawatomie County (long. 96°) by Nuttall (1840), and also near Fort Leavenworth, Leavenworth County (95°), and above that place on the Missouri River, by Harris and Audubon (1843), have already been mentioned. It was again recorded from Fort Leavenworth by Lieutenant D. N. Couch on October 21, 1854, and Dr. F. V. Hayden on April 21, 1856 (Baird, 1858), and by J. A. Allen (1872) in May, 1871. Scott (1879) found it very abundant at Mound City, Linn County (95°), March 8, 1874, and Coale (1894) secured specimens from a small flock at Fort Riley, Geary County, on March 18, 1890. Iseley (1912) reported it as abundant during migrations at Wichita, Sedgwick County. Cooke (1913) reported it from Onaga, Pottawatomie County (96°) and also (1888) from Emporia, Lyon County (96° 15′) and Manhattan, Riley County (96°30′). The Christmas censuses published in *Bird-Lore* record it in addition from Pittsburg, Crawford County (Compton); Lawrence, Douglas County (also by Johnson, 1919, and Lindsdale and Hall, 1927), and Independence, Montgomery

County (Wetmore); Topeka, Shawnee County (Howard and Hyde); Clay Center, Clay County, and Abilene, Dickinson County (Graves); Woodbine, Dickinson County (Mitsch); Hesston, Harvey County (Hesston Audubon Society) and McPherson, McPherson County (Nininger), these localities all lying between about longitudes 95°15′ and 97°30′. From the Kansas City region Harris (1919b) summarizes thus: "If the winter be exceptionally severe, as in 1916-17 and 1917-18, only a few hardy birds remain to find shelter in the dense cover of the Missouri bottom undergrowth. During open and mild winters a few may be found in the hedges and weed patches of the prairie country." There are but little data on the westward range, but, as in Nebraska, there are evidently very few records of its occurrence west of longitude 99°. Cooke (1884 and 1888) quotes Dr. Watson of Ellis, Ellis County (99°30′) as reporting that they usually occur there in the fall and spring and are sometimes abundant. Cooke and Wooster (1929) report eight of them from Hays, a little to the east in the same county, on December 22, 1928, and Prof. L. D. Wooster (letter July 10, 1928) writes that he saw a few there on February 3, 1928, and thereafter.

Oklahoma

The distribution of the Harris's Sparrow in Oklahoma is much as it is in Kansas; that is, there is an abundance of the birds between longitudes 96° and 98°. Cooke (1884) reported it as present all winter at Caddo, Bryan County (96°), in southeastern Oklahoma, and at Darlington, Canadian County (98°) in central Oklahoma. It is listed by the Nices (1924) as a "common winter resident" in Washington County (96°) (Kirn), as "abundant all winter" in Cleveland County (97°30′), and as "common along all timbered streams" in Comanche County (98°30′) (Lantz). The Christmas censuses published in *Bird-Lore* record it from Muskogee, Muskogee County (Little); Tulsa, Tulsa County (Neville); Okmulgee, Okmulgee County (Force); Sapulpa, Creek County, and Tonkawa, Kay County (Beard); Oklahoma City, Oklahoma County (Saunders), and Norman, Cleveland County (Nice), these localities all lying between longitudes 95°15′ and 97°30′, as in Kansas. Prof. R. O. Whitenton (letter April 16, 1928) reports it from Stillwater, Payne County (97°). The Nices (1924) also report it as a "common migrant" at Gate, Beaver County, in the Panhandle just west of longitude 100°, on the authority of Mr. W. E. Lewis, who writes (letter May 11, 1928) concerning this record: "In 1916 and 1920 they were quite abundant in migration the first week of March. I do not find them recorded in other years."

Arkansas

The few records of the Harris's Sparrow from Arkansas are mostly from the northwestern corner of the State. Smith (1915) saw several in May and October, 1913, near Winslow, Washington County, and Lano (1922-1926) also found small numbers of them at Fayetteville in that county at Christmas time. Howell (1911) had only one specimen from Van Buren, Crawford County (Hanna). Mr. S. H. Weakley of Fort Smith, Sebastian County, writes (letter April 16, 1929) that in February, 1929, he banded three of these sparrows, the first which he had seen in that locality. In eastern Arkansas, Pindar (1924) reported it eommon at Helena, Phillips County, in the fall of 1888, but rare at Marked Tree, Poinsett County, early in 1889. Mr. J. G. Boyce of Texarkana, Miller County, writes (letter April 28, 1928): "My own field observations have been limited to three or four counties in the southwestern part of the State, and I have never seen it."

Texas

Harris's Sparrows winter abundantly in central Texas, between longitudes 97° and 99°, north of latitude 29°. Cooke (1884) reported them abundant all winter at Gainesville (long. 97°, lat. 33°30′), near the Oklahoma line. Mr. G. M. Sutton has kindly loaned manuscript notes from Tarrant County (97°, 32°30′) indicating that in January and February he found them among the commonest birds in the wooded sections. Ogilby (1882) reported them wintering in Navarro County (97°, 32°). Simmons (1925) has discussed them as they occur at Austin, Travis County (97°45′, 30°30′) in some detail. There are reports from the region of San Antonio, Bexar County (98°30′, 29° 20′) by Dresser (1865)—the first record of the species for Texas—and Griscom (1920). Attwater (1892) reported them there as "common winter residents but more abundant during migration." This suggests that some may winter south of latitude 29°. Beckham (1888) found them "one of the most abundant and conspicuous inhabitants of the luxurious fringe of vegetation that bordered the San Antonio River," but only once seen in the mesquite. He saw "only a small party" at Beeville, Bee County (97°40′, 28°20′), which is the farthest south the species has been recorded, and none at Corpus Christi (south of 28°) or Leon Springs. The latter place is only about ten miles southeast of Boerne, Kendall County (98°45′, 29°30′), where Brown (1882) found them abundant in the winter of 1880, and Griscom (1920) found them from December 15, 1917, to January 10, 1918, so their apparent absence there was probably merely an oversight.

At Kerrville, Kerr County (99°, 30°), thirty miles northwest of Boerne, Lacey (1911) reported them as occasional but not common, and Smith (1916) found small flocks during the coldest weather. The farthest west this bird has been reported from Texas is Concho County (100°, 31°30′) where Lloyd (1887) found them rare in the fall migration. The farthest east are the records of one each seen on an island in Galveston Bay (94°45′), May 5, 1923, by Bent (1924) and at Eagle Lake, Colorado County (96°20′, 29°40′), by Wetmore (1918), the latter having been reported in the *Bird-Lore* Christmas census for 1917. Other Christmas census records are from Dallas, Dallas County (Reed); Fort Worth, Tarrant County (Iseley); Taylor, Williamson County (Tullsen); and Austin, Travis County (Taylor); all between longitudes 97° and 98°, and north of latitude 30°.

East of the Mississippi River

Wisconsin, as reviewed by Cahn (1915) has numerous records, chiefly from the southern half of the State and mostly within seventy miles of its southern boundary. The northern half of the State is represented by four locality records (Marathon, Barron, Dunn, and Trempealeau Counties) in the western part, and one each in the northern and eastern parts. The first definite Wisconsin record is that of Dr. Hoy, a specimen from Racine, Racine County, taken in May, 1856 (Nelson, 1876). Coale (1884) reported the capture of three specimens at Trempealeau, Trempealeau County, which according to Cooke (1884) were taken in the fall of 1883, and are no doubt the same three specimens referred to by Ridgway (1889) as taken at LaCrosse (about eighteen miles farther down the Mississippi) by Coale on October 3, 1883. Kumlien and Hollister (1903) report that in Dunn County, J. N. Clark collected a pair of these sparrows on May 12, 1886, and three from a flock of four on October 5, 1890, after which he saw a flock of six or eight near Meridian on October 19, 1892, and a few individuals each fall subsequently. They especially mention a pair found by Mr. Clark on the late date of July 4, 1892, and record a specimen from Iron County and three from Lake Koshkonong, Jefferson County, one in the spring and two in the fall. Cooke (1913) records it from North Freedom, Sauk County, October 3, 1903, and Elkhorn, Walworth County, May 15, 1909. Cahn (1915) records two birds seen May 20, 1912, five seen October 8, 1912, and three seen October 5, 1914, all at Unity, Marathon County, by D. C. Mabbot, and the following thirteen birds seen in May, 1914: One taken by himself at Oconomowoc, Waukesha County (9th); one seen at Madison, Dane County (R. E. Kremers); one seen at Barron, Barron

County (E. W. Meadows and L. S. Cheney); three seen at Neenah, Winnebago County (D. C. Mabbot) (10th); three seen at Madison (A. R. Cahn); one at Milwaukee, Milwaukee County (Mrs. M. L. Simpson, 1914); one at Mineral Point, Iowa County (Emma E. Padon) (12th); one seen at Unity (B. W. and D. C. Mabbot); and one at South Wayne, Lafayette County (Rose B. Eastman) (13th). Since 1914 the Harris's Sparrow has been observed at Madison, May 11, 1916 (Schorger, 1917); October 21, 1917 (Schorger, 1926); May 21, 1921 (Taylor, 1922); September 9, 1922 (Schorger, 1926); October 3, 1923 (Taylor, 1926), and May 16, 1926 (Schorger, 1926).

Illinois has about the same number of records as Wisconsin, and they are, in agreement with the Wisconsin ones, mostly scattered over the northern half of the State. The first Illinois records are those cited by Ridgway (1880), of specimens collected at Bloomington, McLean County, in the spring of 1877, and at Normal, a few miles to the north in the same county, on November 14, 1879, by W. H. Garman. Poling (1890) collected two specimens, a male and a female, in Adams County (near Quincy). According to Widmann (1907) this bird has been collected at Warsaw, Hancock County, by Mr. Chas. K. Worthen. Cooke (1913) recorded it from Canton, Fulton County, March 14, 1894, and from Chicago, Cook County, May 19, 1897. Dunn (1895) records the securing of a specimen at Riverdale, near Chicago, on October 6, 1894. Woodruff (1907) recorded one seen by Mr. Ruthven Deane in Lincoln Park, Chicago, on May 11, 1904, and Daggett (1908) recorded a male collected from a flock of Slate-colored Juncos by Mr. L. E. Wyman at Beach, Lake County, October 13, 1907. Cahn (1915) recorded this species from the Chicago region in Cook County, on the authority of Mr. G. A. Abbott, on April 20, 1912; April 20, 1913; and April 17 and 20, 1914. In the spring of 1914 the same unusual migration of Harris's Sparrows that passed through southern Wisconsin also passed through northern Illinois. At Port Byron, Rock Island County, on the Mississippi River in the northwestern part of the State, Schafer (1914) saw one on March 15, another on April 26, two on May 3, and one each on May 5 and 7, 1914. He (1915) saw one also on May 9, 1915. At Rantoul, Champaign County, Ekblaw (1914) saw twelve on April 26, 1914. Leopold (1921) saw three in a large flock of White-throated Sparrows near Chicago on September 26, 1920. Since 1920, Harris's Sparrows seem to have become more common in migration in the Chicago region. According to Sanborn (1921) Mr. B. T. Gault saw one in Humboldt Park on May 14, 1921, and Mr. G. P. Lewis saw one

near Jackson Park on September 22, 1921, and later the same writer (1922) reported that Mr. W. I. Lyon trapped one at Waukegan, Lake County, north of Chicago, on October 12, 1921, and retook it thirty-two times before it left on October 30. Leopold (1923) recorded that Mr. Lyon trapped and banded two in 1922 at Waukegan; that Mr. C. J. Hunt saw one in Lincoln Park on September 23, 1922; and that Leopold and G. P. Lewis saw two there on September 26, 1922, on which date Mr. C. C. Sanborn collected one at Beach. Sanborn (1923) also reported a specimen taken in the fall of 1922 on the lake shore north of Chicago. Mr. William I. Lyon writes (letter November 13, 1928) that he has banded twenty-six Harris's Sparrows at his station at Waukegan, eleven of them in the fall of 1928.

The first Indiana record was from Sheridan, Hamilton County (long. 86°, lat. 40°), May 4, 1907, recorded by Cooke (1913). The second was an immature female taken at Miller, Lake County, October 3, 1920, by Stoddard (1921). Later Stoddard took additional specimens at Miller, according to Eifrig (1921), Leopold (1923) and Bretsch (1926). Bretsch (1926) trapped and banded a male at Gary, Lake County, Indiana, on May 17, 1926.

In Michigan there seems to be a very sparse but more or less regular migration across the northern peninsula, especially in the fall. Barrows (1912) recorded that Mr. O. B. Warren noted the species at Palmer, Marquette County (long. 87° 30′), in the falls of 1893, 1894 (one collected on September 30) and 1895, tolerably commonly in the two last-mentioned years, in flocks of White-throated and White-crowned Sparrows, but that it was not seen in the spring. Gregory (1920) reported it migrating rather commonly at Huron Mountain, Marquette County, in the fall of 1919, he noting six birds on September 26 (one taken); one on September 27; four on October 2; one on October 3 (taken) and one on October 6. He later (1928) reported the taking of another at the same locality on October 13, 1924. Barrows (1912) also recorded a female specimen collected at Sault Ste. Marie, Chippewa County (long. 84°20′), February 22, 1900, and a male taken at Battle Creek, Calhoun County, October 12, 1894, by Edward Arnold. Magee (1927) reported that he and Dr. Christofferson had seen this species at Sault Ste. Marie on October 13, 1918 (two), May 21 and 24, 1925 (one each day) and September 26, 1926 (one trapped and collected). In Luce County, at McMillan, about fifty miles west of Saulte Ste. Marie, it was observed by Bryens (1925) as common for a week following May 21, 1924. Herman (1924) trapped one in 1923 at Laurium, Houghton County. The Wing

brothers (1927) recorded it from Jackson, Jackson County, on October 19, 1924, when one was taken in their traps at that place; this, with the Battle Creek record, constituting the only ones from the southern peninsula.

Ohio is represented by seven records. Davie (1898) reported that Mr. J. E. Gould collected one of four or five individuals in a flock of White-throated Sparrows at Columbus, Franklin County (long. 83°), April 28, 1889. The supposed record of Cook (1913) for Columbus, Ohio, April 27, 1889, is evidently a slightly misquoted repetition of this same record, which, except for its recent accidental occurrence in Massachusetts, is the easternmost known record for the species in the United States. Thomas (1926) gives five additional records for Columbus, as follows: November 11 and 12, 1921; April 1, 1923, and April 15 (two) and 27, 1925. Blincoe (1925) recorded seeing a Harris's Sparrow near Dayton, Montgomery County, on October 5, and taking it on October 12, 1924, while it was in company with several White-throated and White-crowned Sparrows.

The first record of the Harris's Sparrow for eastern Ontario is that of Miller (1897) who noted its occurrence at Lake Nipigon, Thunder Bay District (long. 88°-89°, lat. 50°), in September, 1896. Twenty-six years later Koelz (1923) took it again at Lake Nipigon, on July 27, 1922. Saunders (1913) recorded a specimen collected by him March 18, 1907, from a mixed flock of Song Sparrows and Juncos, near London, Middlesex District (81°20′, 43°), and suggested that this species was probably a regular migrant in the northwestern part of the Province, but Taverner (1927) commented that it has not been observed at Isle Royal (89°, 48°) where extended ornithological observations have been made.

The extreme eastern record for this species is that of one that appeared at the feeding station of Fred G. Floyd of Hingham, Plymouth County, Massachusetts, on April 11, 1929, and remained there until April 20, when it was collected by John B. May (1929).

Rocky Mountain Region

Montana has six records of the Harris's Sparrow—four from the Yellowstone Valley in the southeastern part of the State and two from the west central part, but all east of the Continental Divide. Bendire (1889) reported it as not uncommon in the fall migration at Fort Custer, Rosebud County, in company with White-crowned Sparrows and Arctic Towhees, and states that he shot one there as late as October 21, 1885. Thorne (1895) reported it as uncommon at Fort Keogh, Custer County, from September 22 to October 13, 1889.

Cameron (1908) reported seeing one in company with White-crowned Sparrows at Knowlton, Custer County, on May 24 and 25, 1907. Saunders (1921) gave another record from southeastern Montana—at Miles City, in Custer County a few miles from Fort Keogh—and the two western records—from Great Falls, Cascade County, and Gallatin Valley, Gallatin County.

Wyoming seems to be represented by only two specimens, from Douglas, Converse County, taken October 7 and 15, 1894, by Dr. Jesurun of that place, and recorded by Knight (1902).

The earliest Colorado record is that of Beckham (1887) who shot one at Pueblo, Pueblo County, on October 29, 1886, while it was in company with Juncos and Tree Sparrows. Cooke (1894) reported one from Colorado Springs, El Paso County, which later proved to be an erroneous record and was corrected by him (1897). Later he (1900) reported as the second State record one observed on May 10, 1898, at Holly, Prowers County, migrating with White-crowned Sparrows. Smith (1908) reported one shot by Mr. W. C. Ferril near Kit Carson, Cheyenne County, on October 9, 1907, while in company with Tree and Vesper Sparrows. This was cited as the third State record by Cooke (1909) who reported as the fourth record one from New Windsor, Weld County, October 22, 1907 (Osterhout). Warren (1910) recorded a female specimen taken December 15, 1908, at Salida, Chaffee County, by Mr. J. W. Frey. Sclater (1912) summarized the above records and added that of one taken at Butte, El Paso County, January 24, 1908, by Mr. C. E. Aiken. It was reported from Boulder, Boulder County, by Betts (1913), who collected one there on November 5, 1912, and by Beard (1923), who saw twelve there on December 25, 1922. Lincoln (1920) reported it as an uncommon winter resident in the Clear Creek district in Jefferson County just west of Denver, in the winter of 1912-13, suggesting that they might be more common than he had supposed, as he had difficulty in flushing them from the dense thickets. Bergtold (1929) reported its occurrence in Cheeseman Park in the city of Denver on October 14, 1928. Bergtold (1926) reported it from Fruita, Mesa County, west of the Continental Divide, November 1, 1925, and writes (letter April 10, 1928) that another was captured at that place in March, 1928.

The only record for New Mexico seems to be that recently published by Mrs. Bailey (1928) who reported that Mr. George Willet saw two or three of these sparrows on the Rio Grande Bird Reserve, Sierra County, on December 1, 1916. Arizona, also, has but a single record, reported by Cooke (1914) and Gilman (1914), of one taken

by the latter at Sacaton, Pinal County, from among a small flock of Gambel's Sparrows on March 16, 1913.

Pacific Coast Region

In a number of known instances the Harris's Sparrow has wandered west into British Columbia during its migration. The first record for this Province seems to be that of Maynard, who collected a specimen near Victoria, Vancouver Island, early in April, 1891, according to Rhoads (1893a; 1893b).* Another record is that of one taken at Comox, Vancouver Island, November 20, 1894, by W. B. Anderson, published by Fannin (1895a; 1895b), who (1895b) recorded also that Mr. Anderson had seen others at the same place about December 1, 1894, when he collected two additional specimens. Brewster (1895) reported that two were taken and a third one seen by Allan Brooks at Chilliwack, New Westminster District, January 9, 1895, which date was corrected by Brooks (1917) to January 8, and a sight record for April, 1895, added. Brooks (1900) reported that he collected two at Sumas, eight miles below Chilliwack on the Fraser River, January 10, 1895. Later, he (1912) reported specimens taken April 30, 1911, and December 1, 1911 (see also Cooke, 1913), by himself and Mr. J. A. Munro, respectively, at Okanagan Landing, Yale District. All of these localities are in the extreme southwestern part of the Province. Mr. J. A. Munro (letters May 26, 1928, and December 16, 1928) has kindly sent the records of four specimens taken at Okanagan Landing and of two birds banded at Barkerville, Cariboo District, about 200 miles farther north, September 24, 1926. This latter record has recently been published by the McCabes (1929).

The place of Harris's Sparrow on the bird list of Washington State is based on two sight records made by Mrs. Lucy M. Ellis at North Yakima, Yakima County, in November, 1912, and May 14, 1913, and recorded by W. L. Dawson (1914b). He (1914a) also records the taking of two specimens at Medford, Jackson County, Oregon, on February 1 and 2, 1912, by Mr. George L. Hamlin. The report of Wyman (1911) of one taken at Nampa, Canyon County, Idaho, January 1, 1911, from among several seen in a flock of Gambel's Sparrows, may be included with these.

There are six records of the Harris's Sparrow from California, four of them from the Berkeley vicinity. Emerson (1900) recorded

*Since the above was written the senior author has seen a mounted specimen of a Harris's Sparrow in immature plumage in the Provincial Museum at Victoria, labeled "Female, October, 1894, Victoria, A. H. Maynard," which is evidently the second record for British Columbia.

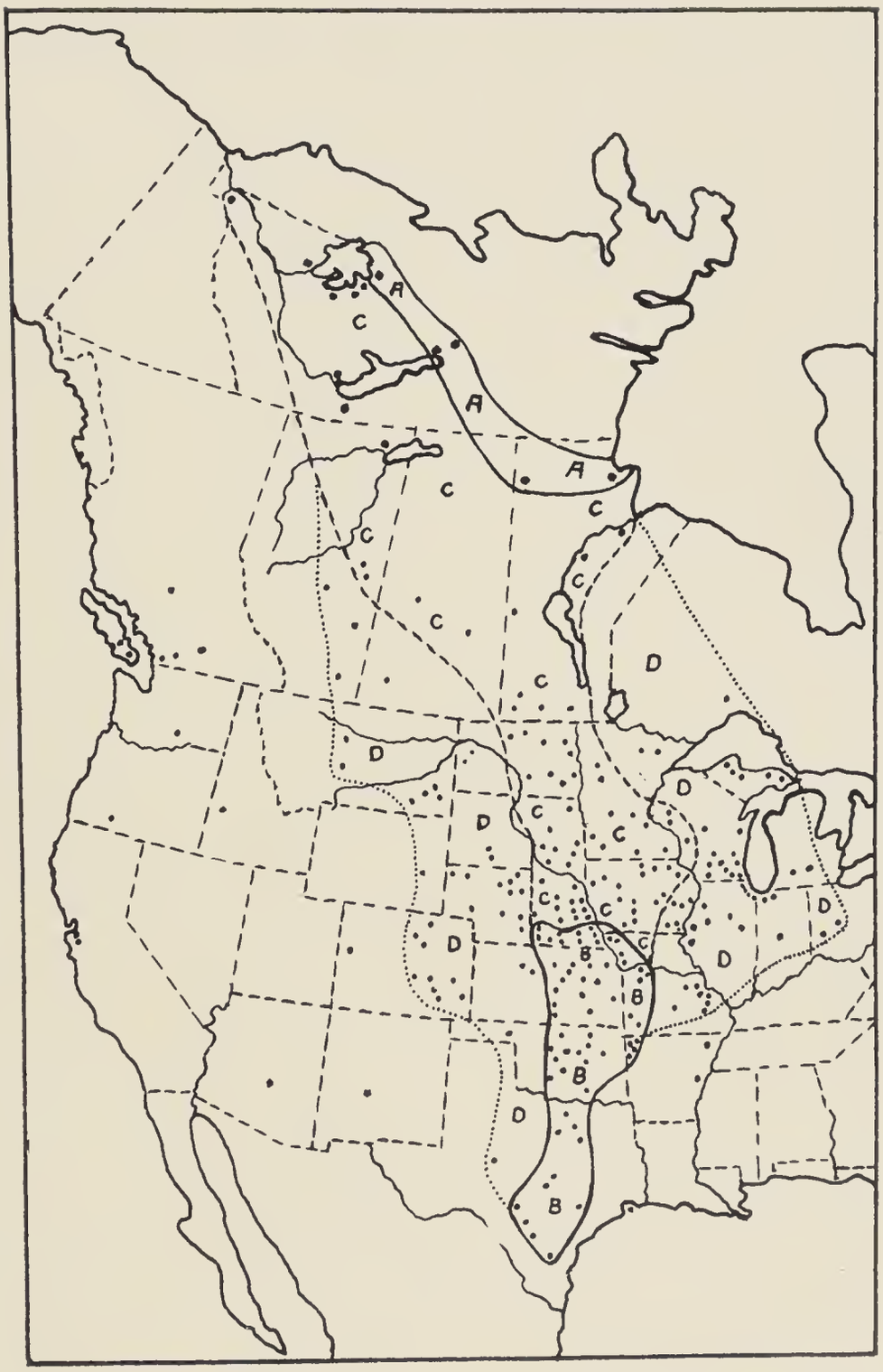


Figure 1. Distribution of the Harris's Sparrow. A=summer range; B=all-winter range; C=area in which it is a common to abundant, more or less regular migrant (enclosed in the dash lines); D=area in which it is an uncommon to rare, irregular migrant (enclosed in the dotted lines). Each dot represents an actual record of its occurrence. Those dots outside the dotted lines represent sporadic or accidental occurrences. The recently made record from Hingham, Massachusetts (Auk 47:392), is not shown on this map.

the taking of one at Haywards, Alameda County, October 28, 1900, while in company with some Golden-crowned Sparrows. Linton (1908) recorded taking one at Smuggler's Cove on the southwest coast of San Clemente Island, October 15, 1907, from a flock of Gambel's and Song Sparrows, and House Finches. Allen (1915) recorded one repeatedly seen in Strawberry Canyon, near Berkeley, Alameda County, during the winter of 1912-13—according to Clabough (1928) from December 25 to February 11—in company with Gambel's and Nuttall's Sparrows. The Fosters (1928) record one that was seen daily for several weeks during the winter of 1924-25 with a mixed flock of Golden-crowned and Gambel's Sparrows and Juncos at their house in Berkeley. Clabaugh (1928) recorded one trapped and banded on November 21, 1927, also in his yard at Berkeley, and associated with Golden-crowned Sparrows. Cozens (1928) recorded trapping one from a flock of Golden-crowned and Gambel's Sparrows at Encinitas, San Diego County, on December 21, 1927.

Fall Migration

The southward movement of the Harris's Sparrow from its breeding grounds probably begins by the last of August, and continues through the greater part of September. Preble (1908) in 1903 observed numbers of them daily from August 27 to September 7 on the southern shore of Great Bear Lake, but after several cold nights early in September they became less common, this probably marking the beginning of their heavier departure southward. They were seen in smaller numbers at various points on the southern shore of Great Bear Lake on September 10, 13, and 14, and the last one was seen at the site of Fort Franklin on September 26. The latest date on which this sparrow was seen at Fort Resolution, according to Cooke (1913), was September 27, 1907. Probably they have deserted the entire region north of latitude 60° by the end of September.

Eastwardly, the vanguard has moved south to latitude 56° by August 30, for on that date in 1900 Preble (1902) found several of them on the upper Hayes River, Manitoba, and they were common near the Echimamish River on September 14, 1900. On that same date, and on September 21, in 1903, A. E. Preble and M. Cary noted individuals at Athabasca Landing, Alberta, according to Preble (1908), while on September 24 three were seen at Lily Lake, all at about latitude 54° to 55°. By the end of September they are common in southern Manitoba and North Dakota. Their arrival at Fargo, North Dakota (lat. 47°), seems fairly uniform and they are common there from about September 25 to October 15.

Minnesota and South Dakota migration records show little difference. Roberts (1879) gives the season for southern Minnesota as September 25 to October 15. Agersborg (1885) gives its season in southeastern South Dakota as about October 1 to November 1. Abundance in southern Nebraska and northern Kansas comes about October 15, but wintering birds do not reach that point until the end of October (see trapping records, p. 167). Harris (1920c and 1922) refers to their presence near Kansas City, Missouri, in numbers on October 10, 19, and 31. He (1919b) writes that they arrive in that region "late in the first week of October and are present in varying abundance until late in November." Miss Edith R. Force (letter July 14, 1928) writes that they were seen at Tulsa, Oklahoma, on October 29 by W. H. Koons. Mrs. Nice (1929) states that they arrived at Norman, Oklahoma, in six years on October 27, 1920; October 29, 1923 and 1925; October 31, 1926; and November 1, 1921 and 1922; a variation of not more than six days. Prof. R. O. Whitenton (letter April 16, 1928) at Stillwater, Oklahoma, gives the earliest as November 4. Their arrival in southern Oklahoma and northern Texas is early in November. Cooke (1884 and 1914b) reported the date of arrival at Caddo, Bryan County, Oklahoma, as November 8, 1883, and also (1913) the average date of arrival at Gainesville, Texas, as November 7. By the close of November they have probably reached the southern limits of their wintering range in Texas.

The migration of the Harris's Sparrow has twice been reviewed by Cooke (1884 and 1913). In the following table we have tried to bring these records pertaining to the fall migration up to date, presenting chiefly selected localities where the most extended records are available:

TABLE 1. The Fall Migration of the Harris's Sparrow.

Place	First Seen No. Yrs. Record	First Seen Average Date	Last Seen No. Yrs. Record	Last Seen Average Date	Authority
Athabasca Landing, Alta.	1	Sept. 14			E. A. Preble (1908)
Winnipeg, Man.	4	Sept. 18	4	Oct. 10	A. G. Lawrence*
Aweme, Man.	22	Sept. 19	22	Oct. 9	N. Criddle (1922)
McKenzie Co., N. D.	4	Sept. 23	4	Oct. 2	A. Larson (1928)
Fargo, N. D.	6	Sept. 23	6	Nov. 5	O. A. Stevens
Minneapolis, Minn.	10	Sept. 24	7	Oct. 23	T. S. Roberts*
Sioux Falls, S. D.	5	Sept. 25	4	Nov. 3	A. Larson (1925)
Lanesboro, Minn.	7	Sept. 27	8	Oct. 14	J. C. Hvoslef
Sioux City, Iowa	19	Oct. 6	17	Nov. 11	T. C. Stephens*
Lincoln, Nebr.	24	Oct. 7	12	Dec. 20	M. H. Swenk*
Ogden, Iowa	5	Oct. 12	5	Oct. 31	W. M. Rosen
Onaga, Kansas	25	Oct. 15		winters	F. F. Crevecoeur
Norman, Okla.	6	Oct. 30		winters	M. M. Nice (1929)
Gainesville, Texas	6	Nov. 7		winters	W.W. Cooke (1913)

*Data collected by

A universal comment is that this sparrow is more common in the fall migration than in the spring. This seems to be connected with the fact that the fall movement is slower—requiring three months to pass from its breeding grounds to the southern extremity of its wintering range—the birds perhaps tarrying in attractive localities or wandering somewhat to one side until urged on by colder weather.

Winter Range

It at first seemed feasible to largely outline the periphery of the winter range of the Harris's Sparrow from the reports given in the Christmas censuses that for the past twenty-nine years have been appearing annually in *Bird-Lore* (volumes 3 to 31; 1901 to 1929, inclusive), usually in the January-February number. However, a more careful study of the movements of this bird have indicated that late December records of its presence in any locality do not necessarily show that it winters through in that locality. In Nebraska, for example, as has already been stated, in spite of the apparently good winter cover for the species along the Missouri and Platte Rivers at Omaha, Plattsmouth, and Fremont, it does not winter through at those localities, but does often linger there until late in December, when it retires farther south for the mid-winter period. The following details from the *Bird-Lore* censuses—each being the only report for the State concerned—help broadly to indicate the extreme northern limits of the *early winter* range of the bird.

Boulder, Colorado (40°)—twelve in 1922 (Beard, 1923).

Dell Rapids, South Dakota (43°45′)—two in 1923 (Anderson, 1924).

Fairmont, Minnesota (43°30′)—two in 1913 (Hagerty, 1914).

Pierson, Iowa (42°30′)—one in 1927 (Mills, 1928).

Springfield, Illinois (40°)—one in 1925 (Knapp, 1926).

These, with other December records published elsewhere, show that in the main path of their migration, that is between longitudes 94° and 100°, a very few Harris's Sparrows may linger well into December north of latitude 40°, and up nearly to latitude 44°, but that the true all-wintering range lies practically entirely south of latitude 41°, and mainly south of 40°. East of longitude 94° and west of longitude 100° even the early winter range of the bird lies at latitude 40° or south of that. In southeastern Nebraska, between latitudes 40° and 41°, and in northwestern Missouri, between latitudes 39° and 40°, is the line of tension of its all-winter range. In Nebraska, at Nebraska City, Lincoln, Superior, Red Cloud, and Hastings, it win-

ters through in some winters only, while at Fairbury it is found in greater or less numbers through every winter. In Missouri, at Kansas City, Harris's Sparrows were reported in eight of seventeen Christmas lists, reaching 4 per cent of the census total in 1909 and 1918. At Concordia they were reported once (1909) in six years, and in that year were present to 1 per cent of the census total. In general, seasons of heavy fall migration in any locality are apt to be correlated with maximum numbers remaining through the winter following, especially if it is a mild one.

Extending southward from southeastern Nebraska and northwestern Missouri the all-winter range of the Harris's Sparrow includes western Missouri and eastern Kansas between longitudes 94° and 97°30′; the northwestern corner of Arkansas; Oklahoma east of 98° 30′, except for its southeastern corner, and central Texas between about longitudes 96° and 99°30′, north of latitude 28°. This area is about 900 miles long, averages about 200 miles in width, and lies closely along longitude 96° as a center, inclining very slightly toward the west from north to south (Fig. 1). A study of the average per cent of individual Harris's Sparrows in relation to the total of all birds seen, as reported from various localities in the *Bird-Lore* Christmas censuses, after eliminating from the total all flocks of 1000 or more Crows, blackbirds, etc., (but including large flocks of Slate-colored Juncos, Song Sparrows, etc.), shows that at Christmas time the center of population of the species is in east-central Kansas and central Oklahoma (Fig. 2). The average per cent in six localities in east-central Kansas varies from 9 to 42, averaging 22, while that in four localities in central Oklahoma varies from 11 to 33, and also averages 22. At the same time in north-central Texas the average per cent in four localities varies from 4 to 15, and averages only 8. The average percentage of Harris's Sparrows to total bird population drops rapidly in eastern Kansas and Oklahoma to from 2 to 5, averaging 3, in six localities. Probably later in the winter the center of population shifts farther south, to central Oklahoma and north-central Texas.

Mrs. Nice (1929) has recently presented data from studies made during the winters of 1925-26 and 1926-27 showing that at Norman, in central Oklahoma, the Harris's Sparrow becomes common by the first or second week in November, and reaches its greatest abundance in December and early January. The abundance at Christmas time varies much from season to season, the extreme variation amounting to 82 per cent in the seven years 1919 to 1926, inclusive, on comparison of the seasons of minimum (1919) and maximum (1923)

abundance. There is a marked decrease during January (about 25 per cent)—probably from birds retiring farther south into Texas—and a still more marked decrease during February (about 35 per cent), when the northward movement starts. Cooke (1884 and 1914b) reported similarly that at Caddo, Oklahoma, in the winter of 1883-84 these sparrows reached their greatest abundance about Christmas time. They were the least numerous from about January 15 to February 23, the return migration making them common again from February 26 to March 15.

Movements within the winter range seem to be subject to considerable variation due to weather conditions and perhaps to food supply or seasonal abundance of the birds. Harris (1919a and 1920a) noted that they were scarce during the fall of 1918 and spring and fall of 1919, yet that the mild and open winter of 1918-19 was the first in memory during which they had remained in the Kansas City region through January and February. However, Johnson (1919) at Lawrence, Kansas, only thirty miles west of Kansas City, found the birds passing through in the usual numbers in the spring of 1919, there being many flocks from March 30 to May 11, with the greatest numbers from April 29 to May 11. Mr. J. A. Neff at Marionville, Missouri, writes (letter April 1, 1928) that these birds "generally begin to arrive here some time after October 20 to 25. Some seasons it is November or even December before they arrive. Some seasons they winter in large numbers, sometimes more sparsely, and occasionally none stay all winter." Smith (1916) noted in Kerr County, Texas, that their presence was coincident with the coldest weather, January 25 to February 5. Griscom (1920) noted in the San Antonio region that they disappeared when the weather became cold (January 10, 1918).

Spring Migration

The northward movement of the Harris's Sparrow begins within its all-winter range about the end of February or the first of March, and during March also spreads more or less into eastern Nebraska and western Iowa. Cooke (1884 and 1888) recorded that at Gainesville, Texas, the northward movement in 1884 began about March 1 and that the bulk had left that place by March 12. He (1884 and 1914b) also reported that at Caddo, Oklahoma, in 1884 an influx of birds from the south from February 23 to 26 brought them from relative fewness to commonness at that place. The bulk of those that had wintered at Caddo moved northward on March 10, but their places were taken on March 13 by another wave of migrants from Texas, which reached

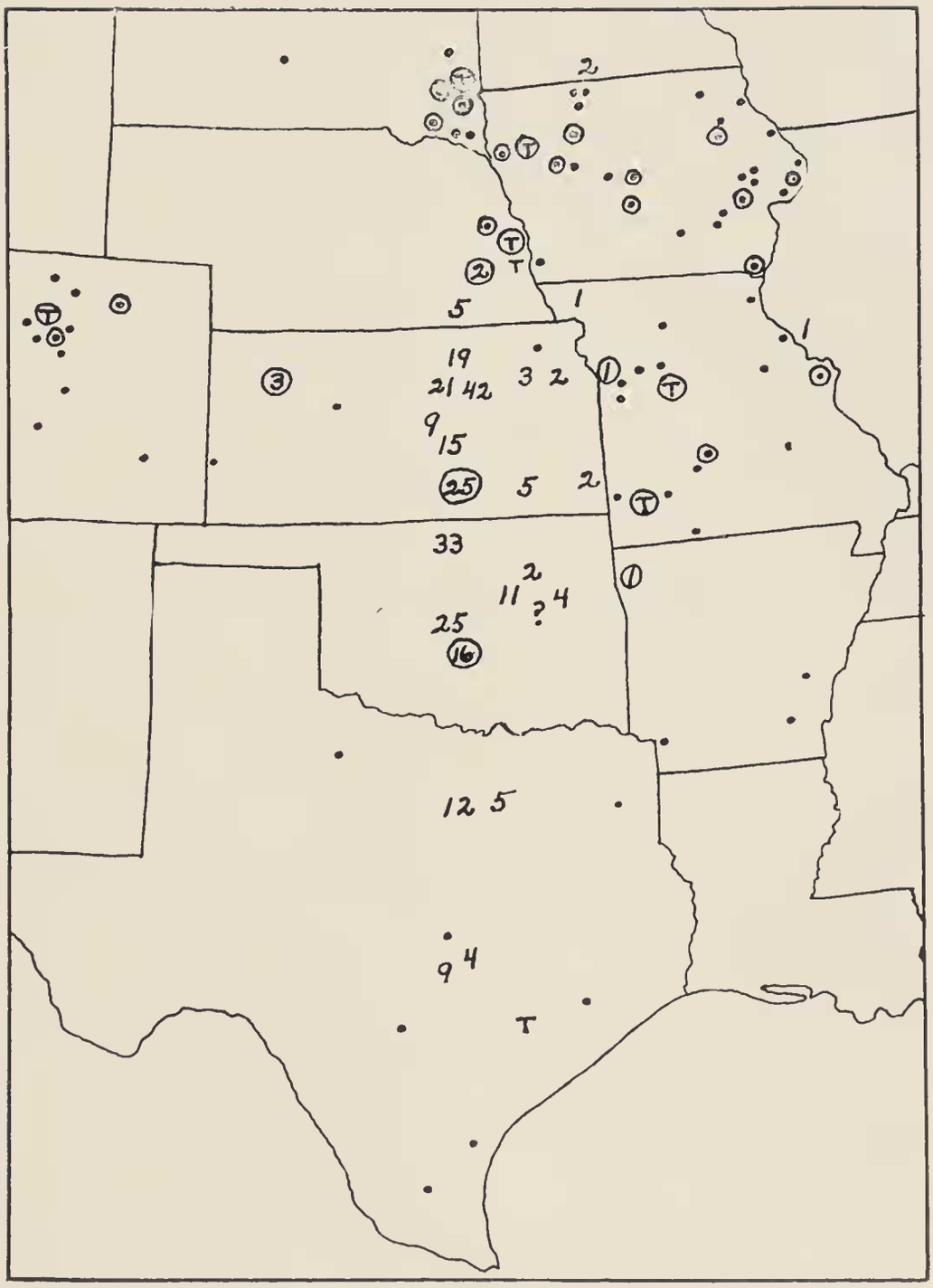


Figure 2. Early winter distribution of the Harris's Sparrow, according to the Christmas Censuses published in Bird-Lore. Numerals represent the average per cent of individuals seen in relation to the total of all birds seen, after eliminating all flocks of Crows or blackbirds of 1000 or more birds. Dots represent reports without Harris's Sparrows. T=less than one per cent. Circles represent localities with records of five or more years.

the crest on March 15 and abruptly ended on March 25. Mrs. Nice (1929) noted that at Norman, Oklahoma, the Harris's Sparrows maintained about a stationary abundance during March—new arrivals apparently about balancing departing birds—at 30 to 40 per cent of the January abundance, but that in April, as the spring migration waxed, there was a loss amounting to 10 to 20 per cent of the January strength, with the last birds departing May 3 to 13. Cooke (1884) says that in this movement the bulk of the birds are only four or five days behind the van, and that in 1884 the bulk reached Pierce City, Missouri, on March 17, and Manhattan, Kansas, on March 18. Harris (1919b) writes of the Kansas City region: "The northward movement begins late in February but is not marked by the characteristic waves, when great numbers are here today and gone tomorrow until three or four weeks later." He mentions (1920b, 1921, 1922b) characteristic waves there on April 3, 11, 12, 22, 23, and 29 and May 11.

In southeastern Nebraska, along the northern edge of the winter range of the species, there is usually a moderate influx of Harris's Sparrows from March 2 to 18, averaging March 14, followed by a stronger arrival from about March 21 to April 5. This movement in many seasons extends up along the Missouri River as far as Omaha (March 13, 1927) or Sioux City (March 14, 1910), and sometimes over western Iowa. The data given by Spurrell (1921) show that the first ones arrived in Sac County, Iowa, about April 1 in 1909, 1911 and 1914 (March 29, April 2, March 29) but not until about May 1 in 1910, 1912, 1913, and 1915 (May 1, May 3, May 1 and May 2). Mr. W. M. Rosen at Ogden, Iowa, sends (letter April 10, 1928) similar data—about May 1 in 1922-1925 and about April 1 in 1926-1928—though the grouping here suggests that closer observations may have been made in the latter years. Mr. J. A. Neff writes (letter April 23, 1928) of northwestern Missouri: "We never see any great numbers until at least March 1, and often not until late March or April." Cooke (1913) has suggested the possibility that the birds seen along the Missouri River in northwestern Iowa soon after the middle of March may have wintered in the bottom lands near by and pushed out into the open country the first warm days of spring, but the continued lack of winter records argues against this. The records indicate rather that these birds are the vanguard of the first spring advance. There is then a long wait, until about the first of May, before the arrival of the birds in southeastern South Dakota (Agersborg, 1885) and southwestern Minnesota indicates the resumption of the northward movement in the final great late wave.

The great late wave of migration passes through southeastern Nebraska between about April 19 and May 14, the latest dates seen being Lincoln, May 21, 1913 and 1916; Peru, May 27, 1889, and Fairbury, June 4, 1928. The first ones of these birds pass on to northeastern Nebraska (Neligh, April 22; Badger, April 23), where there is apparently a halt for about a week. The vanguard arrives with remarkable uniformity during the first week in May or shortly thereafter at points over an area extending from the Dakotas to Minnesota and Manitoba. The passage of the vanguard across Saskatchewan, Alberta and Northwest Territory to the breeding ground of the species is made during the last half of May, though it is probably the middle of June before the migration of all of the birds is completed.

The following table presents migration data on the spring migration, complementary to that given in the preceding table of the fall migration:

TABLE 2. The Spring Migration of the Harris's Sparrow.

	First Seen		Last Seen		
Place	No.Yrs. Record	Average Date	No.Yrs. Record	Average Date	Authority
San Antonio, Texas		winters	2	Mch. 18	W.W. Cooke (1913)
Gainesville, Texas		winters	5	April 7	W.W. Cooke (1913)
Norman, Okla.		winters	5	May 8	M. M. Nice (1929)
Onaga, Kansas		winters	24	May 15	F. F. Crevecoeur
Lincoln, Nebr.	20	Mch. 14	20	May 14	M. H. Swenk*
Sioux City, Iowa (near)	17	Mch. 29	21	May 17	T. C. Stephens*
Lanesboro, Minn.	5	May 10	3	May 18	J. C. Hvoslef
Sioux Falls, S. D.	7	April 30	5	May 19	A. Larson (1925)
Pipestone, Minn.	4	May 3	2	May 30	A. Peterson
Minneapolis, Minn.	11	May 7	5	May 20	T. S. Roberts*
Fargo, N. D.	16	May 8	6	May 26	O. A. Stevens
McKenzie Co., N. D.	8	May 6	3	May 15	A. Larson (1928)
Aweme, Man.	27	May 8	27	May 22	N. Criddle (1922)
Winnipeg, Man.	11	May 8	5	May 21	A. G. Lawrence*
Indian Head, Sask.	3	May 11			W.W. Cooke (1913)
Osler, Sask.	1	May 14	1	June 2	W.W. Cooke (1913)
Eastend, Sask.	5	May 16	3	May 20	L. B. Potter
Flagstaff, Alta	4	May 19			W.W. Cooke (1913)
Hay River (near), Alta.	2	May 19	1	June 15	Preble (1908); Cooke (1913)
Fort Chipewyan, Alta.	1	May 23			E. A. Preble (1908)
Fort Providence (near), N. W. T.	1	May 24			E. A. Preble (1908)
Arctic Red River (near), N. W. T.	1	June 1			W.W. Cooke (1913)

*Data collected by

CASUAL OCCURRENCES

A tabulation of the dates of those records which have been referred to in the paragraphs on distribution during migrations, shows that they are about evenly divided between spring and fall. The most

notable of the eastern records are the group from northern Illinois and southern Wisconsin in the spring of 1914 as reviewed by Cahn (1915). Western records, especially in the coast region, contain many winter dates.

There is an occasional United States record in the summer. Agersborg (1885) reported taking one in southeastern South Dakota in the middle of June, which he found to be an old male with atrophied testes. Visher (1915) also reported one seen in Clay County, South Dakota, June 18, 1912. Cooke (1888) reported one seen at Turtle River, South Dakota, by Abbott in the latter part of July, 1891. Mickel and Dawson (1920) collected a male bird at Lincoln, Nebraska, on July 20, 1919. They found no evidence that the bird had been detained by injuries.

Some of the casuals and late records are undoubtedly abnormal birds. The numerous records of occasional birds somewhat outside of the regular range appear to be individuals which have become separated from their own flocks and attached to flocks of other species. They are almost invariably found in company with White-crowned, Gambel's, White-throated, Golden-crowned, or Tree Sparrows, or with juncos, which are wintering in or migrating through the locality. The gregariousness of the species is noteworthy. While consorting chiefly with their kind, in flocks, they also associate more or less with several other species of sparrows on their regular wintering grounds.

Habitat

The Harris's Sparrows are closely associated with a certain type of country, and this evidently is one of the dominant factors in their distribution. Observers repeatedly comment that the birds are found in brushy places, thickets, edges of groves, weed patches, etc. Reference to the map of plant distribution in the United States by Shantz and Zon (1924) shows that their range corresponds remarkbaly to the areas mapped as "tall grass" and "oak-hickory forest," and especially the meeting place of these two types, where there is considerable open ground and some small tree growth.

They do not range to any extent into the drier, "short grass" country, nor into the more densely forested parts. Food supplies would be less abundant in either of these. Their range in Texas corresponds in a general way to the invasion of the "tall grass" country. In northwestern Missouri, northern Illinois and southern Wisconsin they follow a notable extension of a similar sort. The Colorado localities are mostly grouped in an area near the upper Arkansas River

along which another arm of this area extends from the east. In their summer range, as already described, they are found in a region of stunted timber interspersed with open areas.

Suggestions that the birds are extending their range in this or that region must be considered very cautiously, as these appearances are likely to be due to increased observation. It seems very probable, however, that the planting of groves and hedges along their western limits must have such an effect. Natural extensions of brush and timber up the water courses due to control of prairie fires and probably the clearing of the land in forested areas would have a similar effect.

In eastern Nebraska, western Iowa, and northwestern Missouri the Harris's Sparrows frequent the same habitat and have the same behavior as Goss (1890) has described for Kansas in the following words: "The birds inhabit the thickets bordering streams and the edges of low woodlands. They are usually met with in small flocks. A favorite resort is in and about the brush heaps, where land is being cleared. They seldom mount high in the trees, but keep near the ground upon which they hunt and scratch among the leaves for seeds and insect life." Mrs. Nice (1929) reported the same habits in Oklahoma, and noted their preference for trees covered with vines, which is also characteristic of them elsewhere in the wintering range. She also notes that "when alarmed they, like Tree Sparrows, fly up, instead of diving into depths of cover like Song Sparrows or Fox Sparrows." Jones (1895) pointed out their fondness for hedgerows during migrations. Poling (1890), Dunn (1895) and others have shown that migrating stragglers in Illinois and elsewhere east of the Mississippi frequent brush and bushy places. In southeastern South Dakota, Agersborg (1885) found them during migrations in the brush along the rivers and even out on the prairies in the plum and willow thickets in the ravines. Roberts (1879) says that in Minnesota they frequent open brushy places.

In the vicinity of the Agricultural College at Fargo, North Dakota, there is no natural woody growth and the trees and shrubs of the gardens form a favorite haunt. The birds may be found on the ground near the trees or bushes, on the ground in the road where it is bordered by hedges and in patches of tall weeds (especially *Iva xanthifolia* and *Ambrosia trifida*). When approached they fly up into the lower branches of trees. At sundown they congregate noisily in the spruces, hedges and thicket bushes for the night.

Food

The food of the Harris's Sparrow, during the season that it is in the United States (October to May, inclusive), has been found by Judd (1901), through the examination of 100 stomachs taken in Saskatchewan, Kansas, and Texas, to consist chiefly of vegetable matter, this constituting 92 per cent of the total food. Forty-eight per cent of the food is weed seeds, the seeds of ragweeds and of *Polygonum* (including smartweed, knotweed and black bindweed) constituting 42 per cent, and those of pigweed, lamb's-quarters, gromwell, and sunflower 6 per cent. Twenty-five per cent of the food is the seeds of wild fruits and of various miscellaneous plants; 10 per cent is grain, chiefly waste corn, but also including wheat and oats; and 9 per cent is grass seed, mainly that of blue-grass, bead-grass, crab-grass, foxtail-grass, and Johnson-grass. The 8 per cent of animal matter consists of insects, spiders, and snails, with a marked preference for leaf-hoppers among the insects, these constituting 2 per cent of the total food. Aughey (1878) found fourteen grasshoppers and five beetles, as well as other insect larvae and seeds, in the stomach of one examined in Nebraska in September, 1874. Cahn (1915) found in the stomach of one shot at Oconomowoc, Wisconsin, May 9, 1914, only a small amount of vegetable matter (less than 5 per cent), but numerous ants (including eight large black carpenter ants and two small red ones), two wireworms, a small soft-bodied larva, remains of moth wings, one nearly entire ground spider and additional spider jaws, and one small snail-shell. Nehrling (1896) found that captive birds ate grasshoppers, moths, beetles, millet, kafir, and canary seed.

Mrs. Nice (1929) reported that in Oklahoma they ate poison ivy berries and elm blossoms, as well as weed seeds. At the feeding shelf they were especially fond of canary and sunflower seeds, both of which they cracked, holding the latter flat in their bills. Mary B. Salmon (1928) reported that they ate millet, small grain and cracked corn at feeding stations in the winter in northwestern Missouri. In trapping, millet and chickfeed (mixture of ground grains) have been taken freely. Several trap operators (Dales, Over, Stevens) have noted that the birds are very fond of hemp seed. They did not take rape however (Stevens). In Nebraska they are very fond of corn, taken from the fallen ears, in the fall.

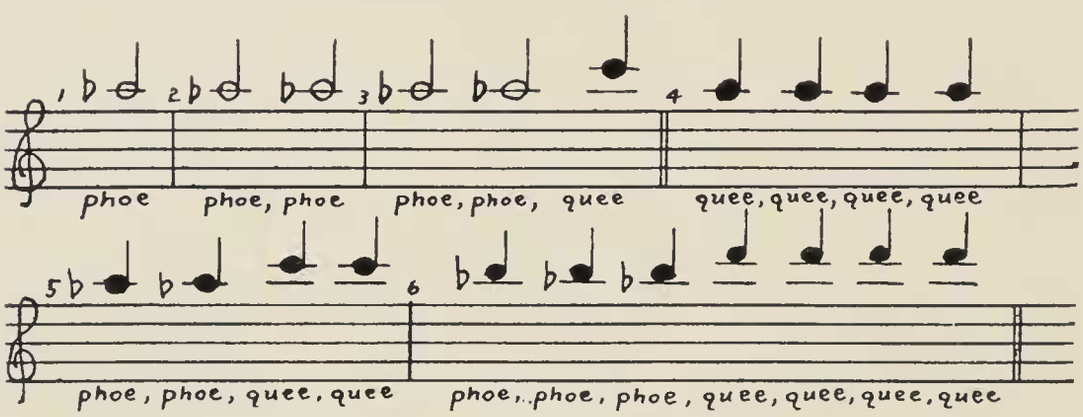
We know almost nothing regarding the food of the nestlings but presumably it would be mostly insects, the seeds and fruits of various wild plants being used later in the summer.

Voice

On its breeding grounds the Harris's Sparrow evidently does not indulge in frequent or voluble song after the nesting duties are well under way. Preble (1902) says that at Fort Churchill in latter July he "heard no song, but they had a loud metallic chip which was audible and easily recognized at a distance of several rods." Seton (1908), after having repeatedly observed the species in the Great Slave Lake region in latter July and August, notes that he "found the species in full song September 3," thus intimating that prior to that time the birds were not singing. Coues (1874), noting the arrival of this species in abundance on the Mouse River in north-central North Dakota, September 18, 1873, wrote: "The birds came from the north, just as the White-throat does, silently and unperceived. . . . They had no song at this season, nor indeed any note excepting a weak chirp." He had noted them also at Fort Randall, Gregory County, South Dakota, in October, 1872, and noted that "they uttered at intervals the usual sparrow-like chirp, but I heard no song." Roberts (1879) says that at Minneapolis, Minnesota, where the bird is a regular and at times a common migrant, he has "never heard any song except on one occasion. That was in the fall when a bird in the plumage of the year uttered a low, continuous warble as it sat on the top of a brush pile. This was repeated many times, and reminded one somewhat of the subdued singing of a Tree Sparrow, often heard in the early spring."

But when the region south of latitude 41° is reached by the southbound Harris's Sparrows, a region where the birds will linger in abundance from late September to late October, and commonly even to November or middle December, or else remain through the winter, their whole vocal behavior changes. The autumn is ordinarily a season when bird songs are conspicuous by their absence, but in the region mentioned the Harris's Sparrow sings as sweetly, if not as fully and volubly, in October as in May. It especially likes to sing in chorus in the evening, shortly before nightfall. At this season the song commonly consists of one or two drawling minor whistled notes (1, 2), sometimes followed by a third note at a different pitch (3), all relatively slow and subdued as compared to the spring song, and very like the abbreviated songs of our other *Zonotrichias* at the same season. On bright days during the entire winter its more or less abbreviated song may be heard. As spring approaches the song becomes complete and more sustained. Goss (1890) wrote "they com-

mence singing early in the spring, and upon warm, sunshiny days their song can be heard almost continually." Iseley (1912), regarding southern Kansas writes: "About March 1 they begin to sing in chorus." Scott (1879) from Mound City, Kansas, writes of early March: "On sunny days they were constantly singing in a strain very like that of the White-throats but a little more prolonged and perhaps louder." The following notations show typical fall songs (1, 2, 3) and spring songs (4, 5, 6) of the Harris's Sparrow, taken down by Mrs. Jane B. Swenk in October, 1925, and May 1929:



The commonest note of the Harris's Sparrow is the one that has been called an alarm note, though it seems to have a more general use. It varies in intensity from weak to strong, according to the circumstances of its emission. It has been variously rendered as "a weak chirp" (Coues, 1874); "a loud, metallic chip" (Preble, 1902); "trying to say *chink* and *peep* at the same time" (Cooke, 1914); "a metallic *zink* of rather coarse timbre" (Harris, 1920) and "a loud, staccato *tchip*" (Nice, 1929). To us it sounds like "spink" or "clink." This note is much like the parallel note given by most sparrows. It is most commonly given when the birds are assembled in groups, especially at night-fall, and may be given singly or repeated several times. Then there are the very characteristic harsh notes—characterized as a "queer chuckle" (Cooke, 1914); a "grating, burring whistle followed by a series of low, gutteral rattling notes impossible to render in words" (Harris, 1920) or "querulous exclamation or 'scold', a curious, grating, chuckling series" of "absurd grumblings" (Nice, 1929). There is also "a gentle *tseep*, not often heard" (Nice, 1929), and a more or less subdued, sociable "*ku-ku-ku*" note.

The primary song of the Harris's Sparrow has the typical *Zonotrichia* general quality, but is quite distinct in structure from that of any of its congeners, and may have interpolated in it discordant notes

that are absent in the songs of the White-crowned, Gambel's, or White-throated Sparrows. It especially lacks the definite form and even rhythm of the White-throated Sparrow's song. It consists of one to five, usually two or three, whistled notes, usually minor tones of a more or less quavering and plaintive character (5, 6) but sometimes clear and full (4), all on the same high pitch (usually in the second octave above middle C)—which may be syllabalized as "*phoe, phoe, phoe*" or *quee, quee, quee*" or "*whee, whee, whee*"—followed after a very slight interval by one to four, commonly two or three, usually natural notes at a different pitch, at an interval of a half-step to a major third higher, but sometimes correspondingly lower, the last one or two being sometimes intermediate in pitch between the two series of notes. In the spring this song is repeated over and over, with variations in the number and pitch of the notes, for minutes at a time. Most singers during the winter and early spring "incongrously intersperse" between many of the series of beautiful whistled notes an occasional "low husky note repeated three or four times" and a number of the characteristic harsh grating notes of the species, but this tendency is diminished or lost during the late spring migration, when the song becomes a thing of maximum sweetness and beauty, and the singer exceedingly voluble. "When several birds are whistling in concert, each individual may take a different pitch, or several may be on the same pitch, but the ensemble gives an impression of querulous minors most unusual among birds and most delightful to hear" (Harris, 1920).

Plumages and Molts

Preble (1902) reported the taking of young Harris's Sparrows, just from the nest, at Fort Churchill, on July 24 and 25, 1900, and described them as follows:

"Upper parts dusky black, the feathers edged with deep buffy and brown, the black predominating on crown, the brown on hind neck, and the black and brown about equally divided on back; outer wing quills edged with deep buffy, inner with brown; tail feathers edged and tipped with whitish; sides of head and lower parts buffy; chest and side streaked with black, which is most conspicuous on sides of chest and forms a prominent malar stripe; upper throat grayish white, with fine dusky markings."

As has been mentioned, Seton (1908) and Preble found a nest of the Harris's Sparrow, containing three young birds nearly ready to fly, in the Last Woods at Artillery Lake, on August 5, 1907. These

nestlings were preserved and are now in the American Museum of Natural History. Mrs. Nice, who examined these specimens, referred to them (letter, June, 1929) as "bobtailed and much striped." Chapman (1913) says that they closely resemble the corresponding (juvenal) plumage of the Song Sparrow, which latter is streaked both above and below. This streaky juvenal plumage is molted, so far as the body feathers and wing coverts are concerned, shortly after the birds have left the nest, the quill-feathers of the wings and tail being retained, according to Chapman, who further states that the postjuvenal molt has been completed, and the first winter plumage assumed, by the first week in September. Mrs. Nice (1929) reports that of ten Harris's Sparrows collected by Seton and Preble near Great Slave Lake in September, 1907, and now in the American Museum, one, taken on September 4, is a fully grown bird in the nestling plumage, the other nine being in the first winter plumage. The postjuvenal molt, obviously, takes place chiefly in August.

There are no important sexual differences in the plumage of the Harris's Sparrow, but the seasonal and age differences are considerable. When the species reaches the United States, in September, the birds of the year are all in the first winter plumage, characterized by the chin and throat being white, and the feathers of the crown being black centrally and more or less broadly margined with grayish or pale buffy, producing a conspicuous squamate or scale-like effect (Frontispiece, lower figure). During the following late fall and winter the pale margins of the crown feathers gradually become worn, exposing more and more the black feather centers and producing a gradual darkening of the crown as a whole. A few black feathers may begin to appear among the white ones on the chin and throat as early as October and November. The assumption of the black hood by these birds is very irregular, resulting in a great diversity in the appearance of individual birds. Specimens at hand from Lincoln, Nebraska, show that the first prenuptial molt of the immature birds begins about March 15 and is well toward completion by April 23. At Warrensburg, Missouri, Scott (1879) found these birds all molting on March 27 and they had assumed the breeding plumage by April 27. This molt is only a partial one, involving chiefly the feathers of the head, neck and breast.

Mrs. Nice (1929) has reported in detail the gradual development of the black throat patch and crown in some banded Harris's Sparrows under observation at Norman, Oklahoma, in March and April of

1924. On January 19 three birds (65948, 65949 and 70465) were plainly immature, with no black on the chin or throat and the chest patch brownish. On March 19, 65949 had the chin and throat still white, 65948 had the chin black and 70465 had the chin largely black, two small black spots at the base of the throat, and the crown darker than the other two. Another individual (65950) had the chin and upper two-thirds of the throat black. By April 7, 65949 had the chin black just below the bill and a black spot at the base of the throat. By April 9, 65949 and 65948 had the crown nearly solid black in front and 70465 had the chin wholly black and a black bar at the base of the throat. By April 16, 65950 had the whole chin and throat black, and the crown all black except for two small buffy spots above the bill, and 65949 had black appearing on the sides of the throat and the crown almost wholly black. By April 24, 70465 had all of the black plumage assumed, but less on the left side than on the right, and the cheeks were partly buffy and partly grayish. By May the birds all had the black hoods, gray cheeks and dark brown or black postauricular spot characteristic of the breeding plumage (Frontispiece, upper figure).

After the end of the first breeding season, and as a result of the postnuptial molt, the black crown feathers become more or less tipped, but not distinctly laterally margined, with grayish or grayish white, especially posteriorly, the black throat often has white feathers intermixed, while the cheeks are buffy and the postauricular spot brown (Frontispiece, right median figure). This is the plumage that Ridgway (1901) correctly thought might be that of younger birds than those with the wholly black crown. As the fall and winter progresses the grayish tips of the crown feathers gradually wear off (Frontispiece, left median figure), so that by February, or at least by the time of the second prenuptial molt, in March, the crown is practically entirely glossy black. The adult after the second prenuptial molt, which is less extensive than the first prenuptial molt, and like it chiefly involves the feathers of the head and neck, assumes a black hood of the maximum extent, intensity and uniformity, and this is largely maintained unchanged through the year for life, except for the changes of the cheek color to buffy and the postauricular spot to brown in August for the fall and winter, and the cheeks to grayish white and the postauricular spot to deep brown or black in April for the spring and summer.

The birds in the second winter having a less extended (second) prenuptial molt than the first winter birds, assume their black hoods earlier in the winter—in March rather than in April. Wilson (1896) saw only one hooded bird in a large flock at St. Joseph, Missouri, November 1, 1895. Cooke (1914b) has described how of two birds seen at Caddo, Oklahoma, November 8, 1883, one had the black hood (an old adult in third or following winter) and the other had no black feathers (an immature bird in the first winter). By December 25, when they were present in the greatest numbers, about one bird in a dozen had the black hood (old adults), while half of the rest showed black feathers on the throat and breast (adults in the second winter). By February 18 all were showing black feathers in the crown, and by March 1 some were in the full plumage. Beckham (1887) wrote that at San Antonio, Texas, "towards the end of February the specimens taken were almost in the adult spring plumage." Mrs. Nice (1929) has estimated that at Norman, Oklahoma, in the fall, from one-tenth to one-twentieth of the birds have the black hoods (third winter birds or older); one-third intermediate birds with some black on the head and throat and darker crowns and chest patches than immature birds (those in the second winter), while the rest are of course immature, first winter birds. On March 1, 1926, she saw a flock of sixteen in which two birds had black hoods while the other fourteen had the crowns "in the speckle stage" of becoming black, "each one different from every other."

The variations in the crown and throat markings of first and second winter birds is very great, and they form a practically intergrading series. Of 412 birds banded at Fargo, North Dakota, in the fall of 1928, 108 were classified as adults (including second winter and older birds) and 306 as immature birds.* Of those classified as adults, many had the crown largely black, one had the crown with whitish corners on the feathers, five had the crown black in front but with unusually heavy white tips on the rear crown feathers, five had the crown heavily gray all over and six had the crown buffy. One adult was unusually black on the upper parts and with black and white sharply contrasted on the under parts. Nineteen "intermediate" (= second winter) birds had only partially dark throats, and the crown was either whitish, intermediate, or buffy. The intergradation was so complete that the notes show that a few individuals were recorded differently at different times, within a period of a few days.

*Evidently in two cases there was duplication in the counting.

Seventeen of the birds recorded as immature, because of their white throats, had (usually heavily) whitish-tipped (not buffy-tipped) crown feathers, much as in the second winter adults.

It might here be added that Mr. J. T. Zimmer collected an albescent Harris's Sparrow (an immature male) at Lincoln, Nebraska, on November 4, 1911 (No. 572, collection of J. T. Zimmer).

Size

There is a small but distinct difference in the size of the sexes of the Harris's Sparrow, the adult males measuring consistently larger than the adult females. Ridgway (1901) gave the following extreme and average measurements, in millimeters, based on seven male and seven female adults:

Table 3. The Principal Measurements of the Harris's Sparrow in Millimeters.

	Wing:	Tail:	Tarsus:	Culmen:
Males:	87.12-91.44 (89.15)	79.76-85.85 (83.57)	23.37-24.13 (23.02)	12.70-13.21 (12.95)
Females:	80.01-85.09 (82.80)	77.22-80.26 (78.99)	23.11-24.13 (23.62)	12.19-12.95 (12.70)

The following table gives the extremes and averages in millimeters of the same measurements, and also the total length, for thirteen adult and ten immature males and for six adult and one immature female from Nebraska, chiefly from the vicinity of Lincoln:

Table 4. Measurements of Adult and Immature Harris's Sparrows in Millimeters.

Males:	Length:	Wing:	Tail:	Tarsus:	Culmen:
Adult	175-196(189)	84.0-89.5(87.0)	81.5-88.0(84.3)	22.5-25.0(24.5)	11.25-13.00(12.09)
Imm.	171-193(181)	78.0-89.5(83.0)	74.0-88.5(81.1)	22.5-24.5(23.5)	11.50-12.50(11.70)
Females:					
Adult	176-188(181)	78.0-86.0(82.7)	76.5-83.0(79.8)	23.0-25.0(23.8)	11.00-13.00(12.21)
Imm.	180	79.0	78.0	23.0	12.00

The above shows that the adult birds are usually larger than the immature ones of the same sex. Adult birds are also usually heavier and stouter than immature birds. A typical adult male was found to weigh 36.45 grams, while a typical immature male weighed but 31.67 grams, both taken on the same day at Lincoln, Nebraska. Of thirty-nine birds trapped at Fargo, North Dakota, thirty that were recorded as "large" included seventeen adults and thirteen immature birds, and nine that were listed as "small" included two adults and seven immature birds.

Results from Trapping and Banding

The following table presents a brief summary of results to June, 1928, from the principal stations at which Harris's Sparrows have been banded. We are especially indebted to these operators for their kindness in supplying data and detailed records upon which further discussion is based.

TABLE 5. Summary of Results of Banding Harris's Sparrows at Seven Stations.

Operator	Locality	No. years data	Total No. banded	Per cent of all sparrows	Per cent which repeated
Misses Agness and Susie Callaway	Fairbury, Nebr.	4	598	53	36
Mrs. Marie Dales	Sioux City, Ia.	4.5	104	39	11
W. B. Mallory	Lennox, S. D.	4.5	143	39?	19
Mr. and Mrs. F. W. Commons	Minneapolis, Min.	5.5	67	1	34
O. A. Stevens	Fargo, N. D.	2	391	27	31
Mrs. A. W. Guest	Jamestown, N. D.	1.5	68	13	16
J. R. Morton	Winnipeg, Man.	3	43	12	7

Intensive trapping will make possible many statistical interpretations of the movements of this species. It would be highly desirable that the trapping be carried on uniformly from season to season. This has been subject to some variations on account of the brief period covered and consequent changes in numbers and location of traps. This has been especially true at the Fargo station. Other factors which interfere are: Non-operation of traps due to bad weather and necessary absence of the operator, variations in surrounding conditions, and weather conditions during the principal season.

We believe that in respect to relative abundance of individuals these factors have been taken care of to a large extent by calculating the per cent of Harris's Sparrows in the total number of sparrow species banded. Fluctuations in the numbers of other species and conditions attending their trapping still might affect the results materially. That more birds are taken in the fall than in the spring is shown by the following figures of the number banded at three stations. As already suggested (page 150) this probably is due to the fact that the fall movement is more deliberate.

TABLE 6. Number of Harris's Sparrows Banded in the Fall and Spring at Three Stations.

Station	Fall '24	Spr.'25	Fall '25	Spr.'26	Fall '26	Spr.'27	Fall '27	Spr.'28
Lennox	20	8	54	3	33	1	24	18
Sioux City	30	0	18	0	23	1	27	5
Minneapolis	6	5	16	0	12	5	5	0

RETURNS

The records of "returns" thus far are almost entirely limited to the station at Fairbury, Nebraska. Their distribution according to the month in which they were banded is shown in the following table:

TABLE 7. Return Records of Harris's Sparrows at Fairbury, Nebraska.

Total No. banded to May, 1927		Return records	Duplications*	Individual birds returned	Per cent banded which returned
Oct.	124	1	0	1	0.8
Nov.	53	5	1	4	7.6
Dec.	20	7	1	6	30.0
Jan.	34	22	10	12	35.3
Feb.	13	10	4	6	46.1
March	100	8	0	8	8.0
April	69	6	1	5	7.2
May	37	0	0	0	0.0

*More than one season's record on an individual bird.

The records of returns in the different months from October to May, inclusive, were 5, 9, 11, 5, 4, 16, 9, and 0, respectively (highest in March). The last column shows that the wintering birds returned to the same place to a remarkable extent. Two birds banded in 1924 and three in 1925 were taken in 1928. One of the former, No. 124778, was recorded each year and killed by a shrike on the last date. All of the three of the 1925 birds were recorded in 1927 as was also one other banded in 1925. The records for the winter of 1928-29 show 1, 5, 6, 7, and 9 birds returning after one to five years respectively.

The one return from October banding, No. 356588, was banded October 27, 1925, repeated December 15, 1925; March 2 and 15, 1926; returned November 14, 1926. The November birds which returned were banded on the 1st, 4th, 9th and 13th. One of these has a December record and another a February one, so that this group appears to be wintering birds. The March returns were banded from the 10th to 23rd. Two of them returned in January and February, the others in March (4) and April (2). These may represent birds which wintered in the vicinity or perhaps a short distance away, moving in early in the spring and remaining for some time (though there are no records to support this). The April returns were banded from the 15th to 30th, returning in October, November, March, and April. They may represent migrating birds, though one of them has a December record also.

In the list of returns only those records have been included which were separated by a migration season. In addition to these there are thirty-seven which might be termed "short time returns," where the dates are separated by more than a month (an arbitrary limit). Three of these, Nos. 42145, 42150 and 176051, have been included in the published list of returns by Lincoln (1927). It is noteworthy that thirty-one of this group were birds banded in January, February, and

March, reappearing in March, April, and May, suggesting again a slight shift in winter and early spring quarters.

A single bird banded at Lennox, S. D., March 30, 1925, was taken at the same place March 28, 1926. Mrs. Dales writes (letter April 24, 1929) that at Sioux City, Iowa, on April 8, 1929, she secured a return on a bird banded October 19, 1928. We believe that the failure to secure returns during migration with this as with other species is largely a matter of mere dispersion. The birds banded are a very small fraction of the total population and the chances that one of them will reappear at the same place are very small. They might pass within a few miles or less. The migration pauses of individuals very likely occur at different localities in different seasons, and these stop-overs are probably few, especially in the northern latitudes.

Leopold (1923) suggested that as the birds seemed to be becoming more common in the Chicago region, that individuals might appear from accidental causes and finding conditions favorable, return in migration. Such an explanation seems doubtful. Migration ranges have been established by ages of time during which these accidental causes have been operating constantly. More or less permanent changes are not likely to occur except through material alteration of the biologic conditions.

It seems almost unquestionable that birds find their way back to the same places in the same way that people find daily their own streets and houses. The summer resident bird recognizes his own valley, grove and tree, or town, block and tree, by memory impressions received from continual association. On return from a winter's absence they may wander for some time before finding the place, or they may fail to find it. During migration these associations are too brief and the bird is not in a receptive condition. On the border line, the edge of the winter range, intermediate conditions and short time assocations may occur. This probably accounts in part for the "short time returns" of the Harris's Sparrow.

Repeats

The repeat records should show quite definitely how long individual birds remain in a certain locality. We cannot say positively whether a bird was present before the first record or after the last, but a series of such records together with other observations will yield strong evidence.

At Fargo, in the fall of 1926, the records of 16 birds averaged 3 days; in the fall of 1927, 63 birds again averaged 8 days. At Fair-

bury, from October 1 to 29, 1925, 36 birds averaged 8.5 days. These are the largest series available and show a remarkable agreement. From Minneapolis, 17 birds in fall migrations averaged 7 days. At Lennox, 22 birds in fall migrations averaged 6 days. The shorter time for the last two localities may be due to the smaller numbers of birds present or to less favorable conditions near the trapping station. The latter circumstance would tend to reduce not only the number of birds repeating but also the chances of long periods.

The data so far available are not sufficient to permit any conclusion as to the most common period. In the one group of 63 birds from Fargo, about two-thirds of them were quite evenly distributed from 2 to 8 days. The longest period was 27 days at Fargo in each fall and the longest considered at Fairbury was 17 days. One bird at Minneapolis, No. 154489, had a record of 72 visits in 21 out of 25 days (September 27 to October 21, 1925). One at Fargo, No. 519682, came 99 times in 23 out of 27 days, being present nearly every time the trap was visited. Another, No. 519684, came 42 times in 11 out of 26 days. Whether or not such cases should be included with the rest, remains to be decided from a larger series of records. From the fall of 1928 at Fargo a still larger series of records is available where 214 out of 412 birds repeated. The average time registered by these was 7.6 days. Grouping them into five day periods, 85 per cent of the birds banded in the first period repeated and registered an average of 10.8 days. The proportion repeating decreased to about 40 per cent at the close of the season and the days present to about 4. Periods of 20 to 23 days were registered by 14 birds.

Repeats in the spring migration have been much fewer and of short duration. From the Minneapolis series, 5 birds were recorded over periods of 2 to 5 days. At Fargo in 1928, 34 birds repeated over periods of from 1 to 5 days (average 1.5). In 1919, 45 birds averaged 3 days. The other stations north of the winter range have shown only an occasional spring repeat. The records from Fairbury are more difficult to interpret on account of the fact that unless fairly continuous records are available (which is rare), it is impossible to tell whether the bird has remained without visiting the trap or whether it may have moved away some distance on a more or less definite migration. Most of the strictly fall records already have been discussed, and others as "short time returns," using an arbitrary 30 day limit. The rest may be tabulated as follows:

Table 8. Repeats Records of Harris's Sparrows at Fairbury, Nebraska.

Time (first record)	No. of birds	Av. time (days)
Winter—November 15 to March 10*	36	13
Spring—March 10 to 31	26	12
Spring—April 1 to 15	18	12
Spring—April 16 to May 10	25	8

*Several records fall on March 13 to 15.

These spring records are quite in contrast to those cited from more northern points but this is not surprising when we recall that there is no considerable migration beyond the winter range until about May 1. The following records of birds which were recorded frequently over a considerable period, are of interest:

No. 42150. February 14, March 3, 8, 21, April 13, 15.
No. 176136. March 22, April 17, 19, 24, May 8.
No. 493745. March 26, April 18, 23, 29, 30.
No. 137618. March 28, April 12, 15, 18.
No. 511181. April 2, 7, 11, 14, 17.
No. 511190. April 10, 27, 30, May 4.
No. 665718. April 23, May 5, 7, 9.

Trapping as a General Index of Migration

Methodical trapping offers a mathematical expression of the migration apart from the study of individuals. Figure 3 shows the period of movement at Fargo and Fairbury. The fall of 1925 is used for the latter place because that was the only year when a large number was banded there and the winter records are omitted also because the numbers are small and scattered. Comparisons of the results from the same season at different latitudes is not necessarily more satisfactory than from different seasons, since different dates are represented and weather conditions at the time may be different.

A further study of the fall movement at Fargo is given in Figure 4 where the number of birds banded and repeating each day in 1928 is shown. The weather was somewhat warmer than normal and there seemed to be no very marked periods of arrival and departure. The curve is more even than that for the same period for 1927, perhaps due chiefly to the larger numbers represented. The 1927 records showed a greater preponderance of repeating birds over new banded ones at the close and a complete absence of birds on October 9, the largest numbers being taken about September 25 to 27, October 6 and 17. The bulk of the birds seem to leave about October 10 and this is about the date when the last are seen in southern Canada. It

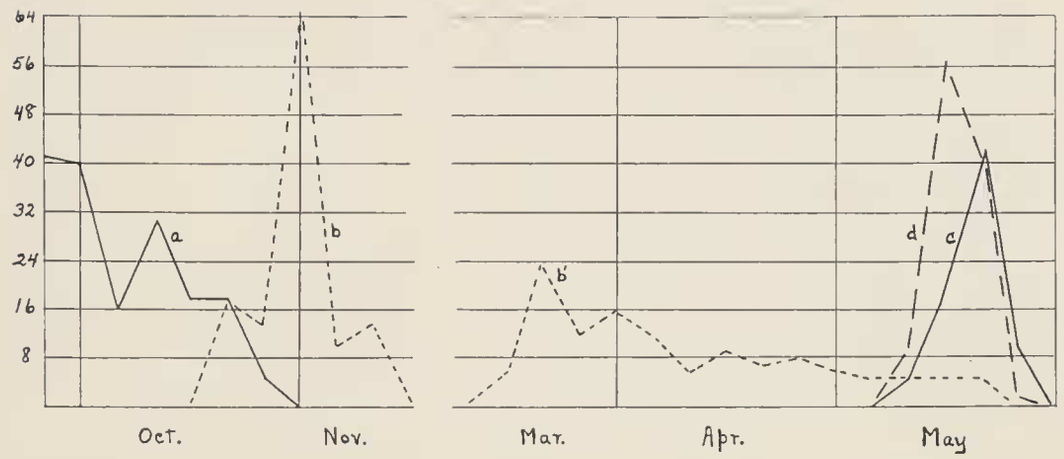


Figure 3. Graph showing the period of migration of the Harris's Sparrow at Fargo, North Dakota, and Fairbury, Nebraska. a=reeord at Fargo in the fall of 1927; b=reeord at Fairbury in the fall of 1925; b'=record at Fairbury in the spring of 1927; c=reeord at Fargo in the spring of 1927; d=same for the spring of 1928.

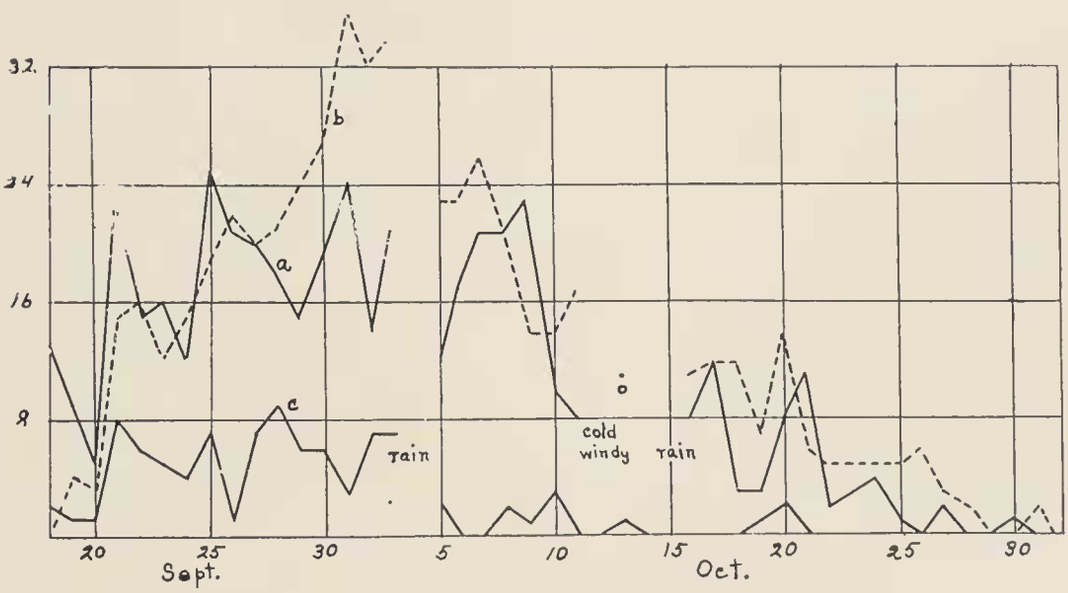


Figure 4. Graph showing the number of Harris's Sparrows banded and repeating each day at Fargo, North Dakota, in the fall of 1928. a=number banded; b=number repeating; c=number repeating for the last time. Dot and circle show number banded and repeating on October 13.

has been observed with other species as well as with this one that the traps are visited most persistently, especially by the banded birds, on the day before a departing flight. Thus the total number trapped would not exactly represent the number of birds present, the figures being relatively exaggerated on the eve of departure and probably minimized on arrival because we cannot say how long it would take the arrivals to find and enter the traps. The results should be studied in connection with general observations on arrival and departure as well as weather conditions.

The results at Fargo indicate that the adults move southward more promptly than the immatures. About 90 per cent of the adults arrived by October 5, but only 50 to 60 per cent of the immatures (94 and 60 per cent in 1927, 88 and 48 per cent in 1928). From the 1928 data, 38 adults show an average stay of 2.4 days, 4 birds showing 10 to 14 days. The rest of the records averaged 8.7 days for the immatures. About 41 per cent of the adults repeated, compared with 57 per cent of the immatures. This difference may be due to the shorter stay rather than greater hesitancy to enter traps.

It has occurred to one of us (Stevens) that it would be of interest to make field counts on the number of banded birds. In the vicinity of the traps this should give an index to the proportion banded, and if taken at nearby places might give some suggestion on the local range of individuals. One such attempt was made on May 16, 1928, when 18 birds were counted, none of which were banded. Five others of which none were banded, were in the traps so that a new group of birds evidently was present. The fall season would be more favorable for this study and the count would best be made a few days after the arrival of a large group. Further attempts in the fall of 1928 were not very successful due to shyness of the birds or lack of time on suitable occasions. One count on September 30 within 40 rods of the traps gave 6 banded and 7 unbanded. Casual observations also suggested that perhaps as many as half of the birds about the traps were banded.

Behavior

The handling of trapped birds and observations upon them in the vicinity gives a good opportunity for notes on their behavior. The Harris's Sparrows are very pleasing birds to handle. They are comparatively quiet in the traps and do not struggle in the hand. Hardly ever will they offer to seize one's hand and usually they will lie quietly when released. Birds which have repeated frequently are much more quiet in the traps and in some cases will cease fluttering

in the gathering cage, allowing themselves to be picked up. They are watchful for an opportunity for release, however, and usually will not lie in the open hand. It has been noted also (Stevens) that such birds often are very reluctant to enter the gathering cage. Usually a banded bird can be recognized on approaching the trap by the more quiet behavior, but in occasional individuals the indications are reversed.

In the open, the birds seem rather domineering over smaller species. Paucity of juncos taken in the fall has been thought (Stevens) to be due to their being kept away by the Harris's Sparrow. In one instance a Harris's Sparrow was hesitating to enter a trap with a drop front. A Tree Sparrow alighted at the rear, and the Harris's Sparrow promptly dove into the trap at the newcomer. A few observations from a blind on the behavior of birds at the sparrow type traps suggest that individual characters of trapped birds may determine the number taken at one time. After entering and feeding for a short time, they usually became restless, and a particularly restless bird might prevent others from entering. Again, one bird would feed in the funnel opening for some time, thus monoplizing the entrance. A second bird, growing impatient, would tweak his tail only to be chased away.

The repeats secured at Fargo in the fall of 1928 have been analyzed with respect to the time elapsing between date of banding and first repeat. This shows 31, 61, 37, 27, 15, 11, 10, 5, 4 and 4 birds reappearing after 0 to 9 days, respectively. Nine more came after intervals of 10 to 23 days, and this group at least may represent birds which had been absent from the immediate vicinity in the interim. There seems to be little relation between the length of this period and the total number of repeats registered. Aside from a few birds which form the trap habit we believe that captures are largely a matter of chance, a random sampling of the birds as they move about from hour to hour and day to day. Although they do hesitate to enter a trap there seems to be no general fear of traps. This is indicated by the data just cited, by the fact that they enter freely into traps suitably located within the first hour or so after the traps are placed, and that disturbance of traps by animals has caused only a very temporary interruption of results.

More than one-fourth of the birds repeating in the fall of 1928 appeared at the two traps farthest apart (75 rods) and half of the others appeared at one or the other pair of traps about half as far apart. Only eight birds came only to one trap for four or more times

Food habits have already been noted. The best location for traps at Fargo has been close against plantings of bushes which furnish dense cover close to the ground (*Ribes, Cornus, Spiraea, Viburnum*, etc.). Weed patches also provide good cover. A trap on a post has given good results when well surrounded by undergrowth, but on the ground is probably the best. Mrs. Dales has contributed an interesting suggestion. Her yard is rather open though there are a good many trees near by. She writes that she cuts branches to stick in the ground to offer temporary cover and this seems attractive to these birds. Probably they are less cautious about entering traps when good cover is close at hand.

Suggestions for Further Study

In common with other species, scarcely any returns have been secured during migration. The winter range and main path of migration are so limited, however, that the establishment of a number of stations along the route would have unusual advantages with this species. Locations in the winter range have exceptional opportunities to study plumage changes, local movements, etc. Several stations in one locality should be able to learn much regarding the local range of individuals.

Systematic trapping is necessary to secure quantitative data which can be used in statistical studies. It is very desirable for the operator to have an assistant so that work will not need to be suspended on account of absence, illness, etc. The recording of repeating birds from day to day is very important in determining whether they remain in the locality. The number of visits registered each day by an individual is of interest in the study of individual habits but perhaps of little importance in generalizations. The operation of the same traps from year to year would be necessary for careful comparison of different seasons. The surroundings, however, may be subject to uncontrollable changes which would affect the results.

There are some problems which seem difficult of approach. We know that many of the birds repeat and that they seem to have little fear of the traps. We do not know whether some of the banded birds fail to re-enter on account of fear. Observations from a blind near the trap and the use of special markings might help to answer this question. It seems hardly possible to determine whether the feeding has any effect in retaining birds in a locality longer than they would remain otherwise. The general results would seem to indicate that this is not a large factor, but that it may operate in the case of those birds which form the trap habit.

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BIRD LIFE OF A TRANSIENT LAKE IN KENTUCKY

BY GORDON WILSON

Bowling Green, Kentucky, though on Barren River, has few water and wading birds regularly. A depression in southern Warren County, some ten miles from Bowling Green, filled with water during the long-continued rainy season from August, 1926, to July, 1927, and formed a lake 300 acres in extent, which lasted until the middle of July, 1927. To this wet-weather lake came hosts of water and wading birds, Mallards, Canvas-backs, Coots, Lesser Yellowlegs, and Solitary Sandpipers being most numerous. During many years of bird study in this region I have found only twenty-seven species of these families; while during the months from February to July, 1927, I found thirty-two species on this lake alone. The following species were recorded for the first time in my territory: Caspian Tern, Semipalmated Plover, Green-winged Teal, Black Duck, Pintail, and Black Tern.

Species that remained until the lake dried up and probably or certainly nested and not otherwise reported from this section of the state were, Black Tern, Mallard, Blue-winged Teal, King Rail, Coot,